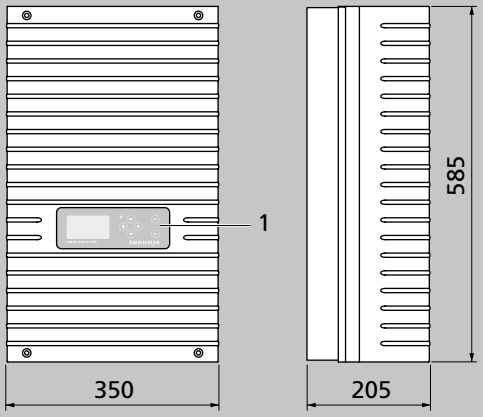
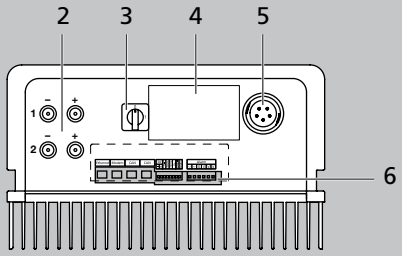
MANUAL

User Manual for
Sunways Solar Inverter
AT 5000, AT 4500, AT 3600, AT 2700



1 Operating field with LCD display, operating LED and keyboard
2 DC connections
3 DC load break switch
4 Rating plate
5 AC connection
6 Communication interfaces



Thank you for deciding in favour of a Sunways Solar Inverter of the AT Series!

In doing so you have purchased an innovative, high-quality product with unique equipment features and a high, constant efficiency. This solar inverter is equipped with HERIC® topology and innovative FP switching, and therefore enables operation on a large number of silicon and thin-film modules – as accustomed from Sunways – without the use of a transformer.

This user manual contains explanations on using the Sunways Solar Inverter. You will learn to recognise the many possibilities of the solar inverter. Information is provided on safety, installation, commissioning, operation and system monitoring.

Please observe the safety precautions exactly to ensure increased safety at the operating site of the solar inverter.

Imprint

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1.0 Product Description

1.1 Proper use

The Sunways AT Solar Inverter is the link between your solar generator and the public power grid. The energy from the connected solar generator is converted to grid-conformant AC current and fed into the grid.

Thanks to the HERIC® topology with FP switching, the AT Solar Inverter has a voltage curve which corresponds to that of a transformer unit with an earthed negative terminal, and is generally also recognized for operation on thin-film modules.

Solar modules which require earthing of the positive terminal cannot be operated with the AT Solar Inverter. If in doubt, always ask your module manufacturer about a release!

1.2 Function description

Conversion from direct into alternating current
The AT Solar Inverter converts the direct current produced by the solar generator into alternating current. The alternating current is then fed into the public power grid.

Operating and display elements
Various interfaces are available for system configuration and monitoring:

- Operating field (LCD display and keyboard) for displaying operating and status values or for inputting system parameters
- Operating LED
- Integrated web server for display and configuration via a web browser

Interfaces

- Bus interface for connecting an analogue modem, ISDN modem or GSM/GPRS modem
- Ethernet interface for connecting a PC or for integration in existing networks

- CAN bus interface for interconnecting several solar inverters
- S0 pulse output for controlling large displays
- Alarm relay for realising simple monitoring locally
- Interface for connecting an irradiation and temperature sensor

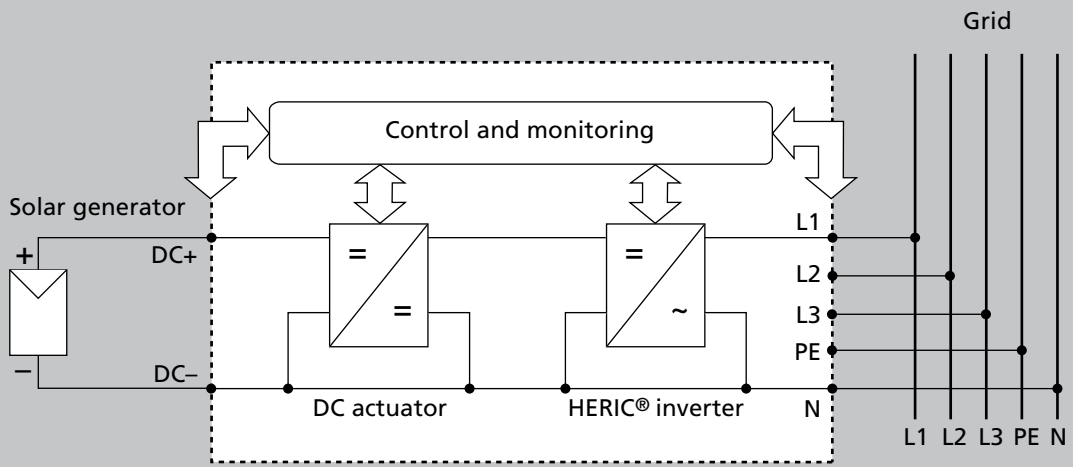
Data logging
The AT Solar Inverter is equipped with internal data logging for recording and saving system data:

- 5-minute mean values of voltages, currents, output, temperature and irradiation (if sensor is installed)
- 5-minute, daily, monthly and annual values of energy yield
- Memory for malfunction messages

Grid monitoring
The AT Solar Inverter assumes the task of grid monitoring for the protection of the unit and persons. In case of abnormal grid conditions, feeding is immediately interrupted and the solar inverter disconnects from the grid by triggering the grid relay.

Design of solar inverter
The principle design of the AT Solar Inverters can be recognised from the block diagram. The most important characteristic of the inverter is the earthing of the solar generator, i.e. the negative terminal is directly connected to the neutral conductor on the grid.
The solar generator voltage connected to the inverter input is always positive and is initially adapted by the DC actuator and then converted to alternating current by the high-efficiency HERIC® inverter. The AC connection is made with 5 wires for a 3-phase feed point (3-phase AC current connection) due to the 3-phase passive grid monitoring, whereby feeding is only single-phase. A 3-wire connection is made at the single-phase feed point (alternating current connection).

Block diagram



Design of solar generator

The technical data of the selected solar generator must be within the solar inverter's specifications (see Technical Data). Incorrect dimensioning can lead to reductions in the yield and to destruction of the unit.

The Sunways design program Sundim may be helpful to you. Sunways Sundim is available on the included CD-ROM or at our homepage www.sunways.de.

Be sure to take the following points into account before planning your system:

- Watch the celestial alignment of the modules. A maximum yield is achieved in Central Europe with a module slope of 30° to the vertical and direction of the solar generator field directly to the south.
- The output of the cells decreases as the module temperature increases. Install your solar generator with sufficient ventilation from behind.
- Check your solar generator approx. every three years for soiling. This occurs especially on the lower edge of the modules and forms a veil that cannot be washed off even by heavy rain. Reduced yield can be prevented by cleaning with a wet cloth or a brush.
- Avoid switching off individual modules or solar cells of your system. This can lead to major decreases in yield.

Standard components of a solar system

Depending on the recommendations of your PV planning expert, your PV system consists of the following components:

1 Solar generator

2 Solar inverter with integrated DC load break switch

3 Mains fuse and energy meter

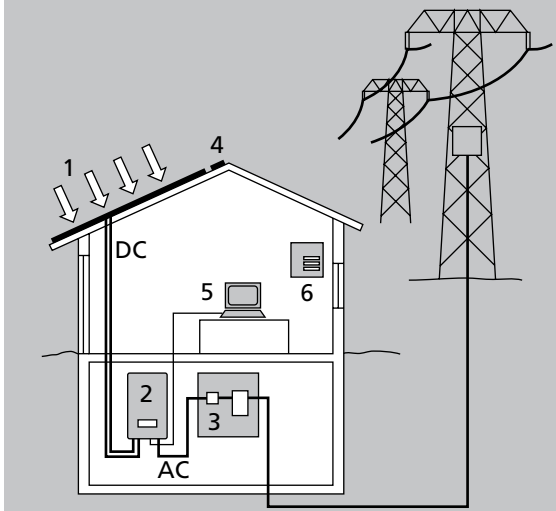
Options

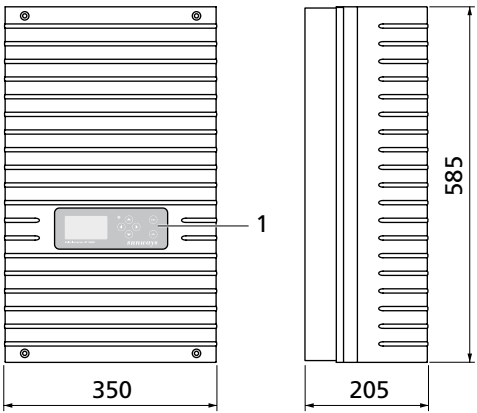
4 Irradiation sensor with integrated temperature sensor

5 PC for monitoring system

6 Large display

Standard components





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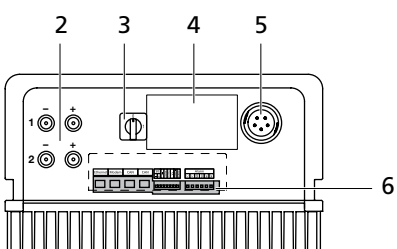


The delivery consists of:

- Sunways Solar Inverter of the AT-Series
- Installation frame
- 2 pairs of Tyco Solarlok plug-in connectors
- AC connector
- CAN terminating resistor connector (connected)
- Ethernet cable, 2 m (CAT 5e, 1:1)

- Manual
- Warranty card
- CD-ROM, including: Sunways Sundim design program, product and service information

Checking delivery
Before shipment our products are checked for proper condition. Despite careful, recyclable packing, transport damage may occur, for which the transport company is generally responsible.

Please check the delivered solar inverter thoroughly!

Should you discover damage to the packing or the solar inverter, please inform the transport company immediately. Your specialist dealer will be happy to support you if necessary. A possible damage report must always be received by the transport company in writing at the latest seven days after receipt of the goods.

2.0 Safety precautions

Observe information in operating manual!
The condition for the safe handling and malfunction-free operation of the AT Solar Inverter is a knowledge of the basic safety precautions.

This user manual contains the most important information on operating the system safely.

Each person concerned with the installation, commissioning, maintenance and operation of the solar inverter must have read and understood the entire user manual, and in particular the chapter entitled Safety Precautions.

In addition, the rules and regulations for accident prevention applicable for the operating site/plant must be observed.

Dangers when handling the AT Solar Inverter
The solar inverter has been built in accordance with the latest rules of technology and the recognized safety rules and may only be used

- for its intended use
- when in proper condition with regard to safety.

Improper use may lead to dangers to the life and limb of the user or others, or can adversely affect the system or other property.

In case of malfunctions which can impair safety, the system must be shut down immediately and secured against being switched on again. The malfunction must then be eliminated immediately.

Warranty and liability

The „General Terms and Conditions of Sale and Delivery“ of Sunways AG always apply. Warranty and liability claims for injuries and damage shall not be accepted if they are due to one or more of the following causes:

- Improper use of the solar inverter
- Improper installation, commissioning, operation and maintenance
- Operation of the solar inverter with defective and/or non-operational safety and protective equipment
- Failure to observe the information in the user manual regarding installation, commissioning, operation and maintenance
- Unauthorised constructional modifications
- Insufficient monitoring of wearing parts
- Improperly conducted repairs
- Catastrophes resulting from the effects of foreign bodies and acts of God.

2.2 Explanation of symbols and warnings

To help you quickly understand this manual and safely use the solar inverter, the following warnings and symbols are used.

Warnings and symbols in user manual

DANGER

This symbol indicates an immediate danger which will result in death, injury or serious damage if the applicable safety regulations are not followed.

CAUTION

This symbol indicates an immediate danger which can result in damage if the applicable safety regulations are not followed.

Symbols

Information
This symbol indicates important information which contributes to a better understanding of the solar inverter.

Warnings and symbols on unit
The following warnings on the housing of the solar inverter point out dangers. Always observe the warnings exactly!

This symbol indicates that the user manual must be read and understood before putting the unit into operation.

IMPORTANT
Hot surface! The housing can heat up during operation.

The unit must be disconnected for the mains supply and from the PV generator before opening the housing. The unit still carries life-threatening voltage for approx. five minutes internally and at the connection sockets of the PV generator following disconnection from the PV generator. The energy storage capacitors are not completely discharged until after this time. You must wait at least five minutes after disconnecting the unit from the mains supply and from the PV generator before opening the unit.

Warning!
High leakage current,
earth connection essential before
connecting supply.

WARNING!
High leakage currents. Be sure to make an earthing connection before connecting the power supply circuit (AC system)!

2.3 Basic safety measures

Electrical work on the solar inverter must be conducted by a qualified electrician while observing the VDE regulations, national and other regulations!

The solar inverter may only be opened by persons authorised by Sunways AG to do so!

When circuit breakers are tripped, the fault cause must be determined and eliminated before returning the unit to operation.

Check electrical equipment regularly!

Retighten loose connections!

Replace damaged lines/cables immediately!

2.4 Safety concept

The following parameters are monitored and displayed continuously and simultaneously by the inverter controller:

- DC overvoltage
- Overvoltage L1 > 10%
- Overvoltage L1 > 15%
- Undervoltage L1
- Overvoltage L2
- Undervoltage L2
- Overvoltage L3
- Undervoltage L3
- Isolated operation
- Overfrequency L1
- Underfrequency L1
- Surge error (brief overvoltage L1)
- DC share in AC current
- AFI residual current jump > 30 mA
- AFI residual current > 300 mA
- Overtemperature of heat sink

When a malfunction occurs, feeding is immediately interrupted and the solar inverter disconnects from the grid by triggering the grid relay.

The potential-free alarm relay is switched (except for grid undervoltage L1).

In addition, the following protective equipment in accordance with overvoltage category III is provided on the grid and on the solar generator side:

- Grid-side varistors
  These protect the power semiconductors in case of high-energy, short-term voltage peaks in the grid and provide for an energy reduction in reactor in case of a grid disconnection.
- Generator-side varistors
  Varistors offer protection against atmospheric overvoltages (e.g. caused by remote strikes during thunderstorms).

3.0 Installation

3.1 Mechanical installation

Requirements for installation location

DANGER

The solar inverter may not be installed in rooms subject to explosion hazards.

The solar inverter may not be exposed to caustic gases!

No combustible or highly flammable materials may be stored within 3 metres of the solar inverter.

Mechanical load-bearing capacity
Note during installation that the solar inverter weighs 30 kg. The installation surface must be firm and able to carry this weight in the long term.

Thermal interaction
The installation surface must consist of flame-retardant material (not suitable: surface of wood or plastic; suitable: concrete and masonry), as the frame of the solar inverter can heat up to a maximum of 70°C.

A minimum distance of 300 mm to other units, cabinets, ceilings, cable ducts, etc. must be maintained above, below and to the sides of the housing.
See the figure Requirements for installation location.

The solar inverter must be installed vertically to enable sufficiently free convection.

Several solar inverters may not be mounted over each other to prevent them from heating each other.

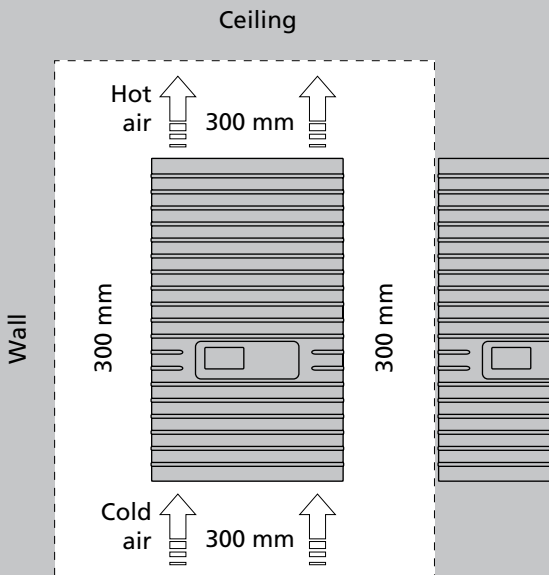
Ensure sufficient heat dissipation when installing the solar inverter in a switch cabinet or closed room.

The ambient temperature may not drop below or exceed -25°C and +40°C respectively. At ambient temperatures above 40°C, the inverter automatically reduces its output.

The solar inverter should not be exposed to direct sunlight to protect it from unnecessary external warming.

Protection against moisture and foreign bodies
The high protection type IP54 allows installation indoors and in roof-covered areas outdoors, however the solar inverter may not be directly exposed to rain.

Requirements for installation location



Installation

Proceed as follows to install the solar inverter:

1. Hold the wall bracket at the point at which you want to attach the solar inverter and mark the mounting holes.

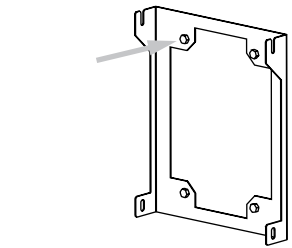
2. Drill the holes with a 10 mm dia. drill bit.

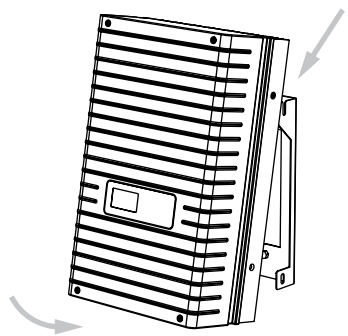
3. Install the wall bracket with corresponding screws and dowels depending on the surface condition.

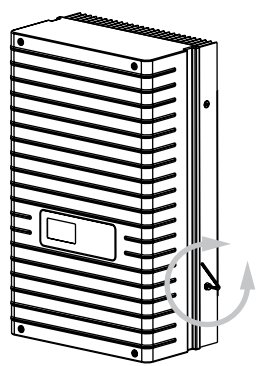
4. Unscrew the locking screw of the solar inverter at the lower left with an Allen key

5. Hook the solar inverter into the cut-outs of the installation frame at the top on both sides.

6. Secure the solar inverter by tightening the locking screw.







Solar generator connection

Extreme danger from electric shock!

Touching live parts can result in death.

All electrical work must be conducted by a qualified electrician while observing the VDE regulations, national and other regulations!

Execute the direct current wiring in accordance with the system dimensioning of your planning expert.

Prepare all solar generator cables before you carry out the connection of the solar generator to the solar inverter.

Check each solar generator string for proper operation with an open-circuit voltage and short-circuit current measurement.

Check using the rating plate on the solar inverter whether it is approved for the maximum solar generator voltage.

The positive and negative lines must be kept electrically separate from the earth potential.

Touchable, live parts of the solar generator (e.g. metal frame, carrying structure, etc.) must be earthed (connection with PE).

Check the solar generator against short-circuits to earth.

Before connecting the solar generator to the solar inverter, the integrated DC load break switch must be opened quickly (position 0).

After the PV solar generator is connected to the solar inverter and the DC load break switch is switched on, the direct generator voltage is present internally.

The connectors may not be separated while under load.

Always separate the solar generator side first by quickly opening the DC load break switch and then the grid connection by switching off the corresponding mains fuse.

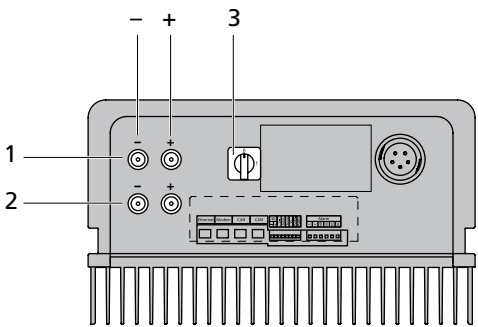
Survey

The solar generator can be directly connected to the solar inverter with two strings. The connection is made via the shockproof Tyco Solarlok plug-in connection system accessible from outside.

The solar inverter has two electrically connected DC inputs, which are arranged in pairs on the underside.

The solar generator strings must be identically dimensioned and comply with the specifications of the solar inverter.

No external DC load break switch is required. A DC load break switch as required in accordance with DIN VDE 0100-712 is integrated in the solar inverter.



1 Connection of solar generator string 1

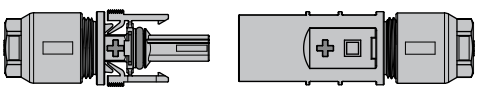
2 Connection of solar generator string 2

3 DC load break switch

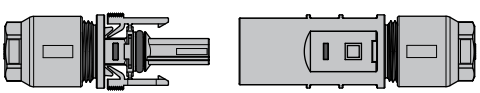
Tyco Solarlok plug-in connection system
The Solarlok plug-in connection system is used for the simple, reliable connection of individual solar generators up to the solar inverter.

Components
The following connectors are used:

· Positively coded connector



· Negatively coded connector



· Neutral connector

The neutral connector can be used to connect both positively and negatively coded sockets.

Installation

Extreme danger from electric shock!

Touching live parts can result in death.

All electrical work must be conducted by a qualified electrician while observing the VDE regulations, national and other regulations!

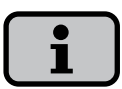
Tyco Solarlok connectors are only reliable for connection on permanently installed lines.

Only the Tyco-Solarlok hand crimping pliers may be used to crimp the connectors.

During preassembly, the connectors must be separated from all other voltage sources.

The connectors may not be separated while under load. The circuit must be opened at a suitable point for this purpose.

Provide the lines with corresponding stickers as close as possible to the connectors to prevent confusion.



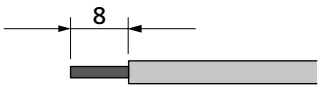
Any kind of soiling (dust, moisture, etc.) has a negative effect on the connector system with regard to function over the intended period of use. This particularly applies to the suitability for use of the seals and the crimping of the contacts. Therefore, extreme care must be taken to achieve proper processing during assembly.

Various circular contacts are used for different conductor cross-sections with the Tyco Solarlok connectors. The correct tool insert must be used in accordance with this cross-section. The included Tyco Solarlok connectors are equipped with circular contacts for a cable cross-section of 4 mm² to 6 mm².
The seals and clamping baskets used in the preassembled connectors are approved for cable sheath diameters from 4.5 mm to 6.9 mm. Special seals and clamping baskets must be used for cables with a sheath diameter greater than 6.9 mm.

The Tyco Solarlok hand crimping pliers can be purchased from your sales partner.

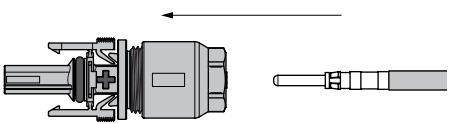
The following sequence must be observed during assembly:

1. Stripping the voltage-free line.

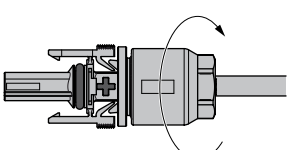


2. Crimping on the circular contact with the Tyco Solarlok hand crimping pliers.

3. Sliding the cable gland onto the line and engaging the contact in the connector housing.



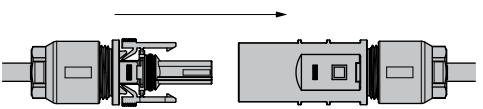
4. Tightening the cable gland with 1.5 Nm.



Handling

The positively/negatively coded connectors are marked with polarity symbols and a coloured ring (blue = negative, red = positive). They are equipped with coding ribs for assignment, which ensures that only connectors of the same polarity can be connected to each other.

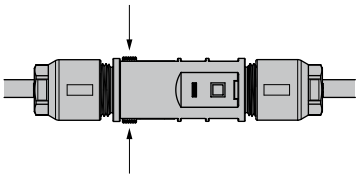
Connecting socket and plug. The system is only correctly locked if the locking hooks are recessed flush in the mating piece.



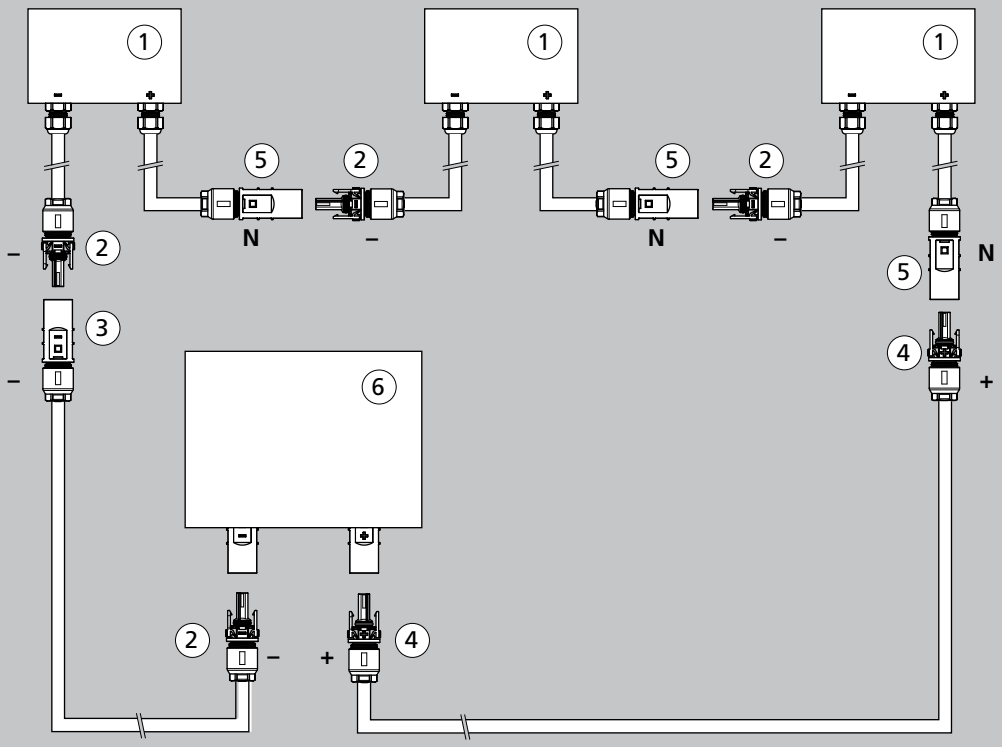
CAUTION

The connectors may not be separated while under load. The circuit must be opened at a suitable point for this purpose.

Release the locking device by pressing on the ribbing of the locking hooks and pulling them apart.



Connection example



1 Solar module box
2 Negatively coded socket
3 Negatively coded plug
4 Positively coded socket
5 Neutral connector
6 Solar inverter

Grid connection

Extreme danger from electric shock!

Touching live parts can result in death.

All electrical work must be conducted by a qualified electrician while observing the VDE regulations, national and other regulations!

Observe the pin assignment of the AC bayonet connector. An incorrect assignment can result in the unit being destroyed.

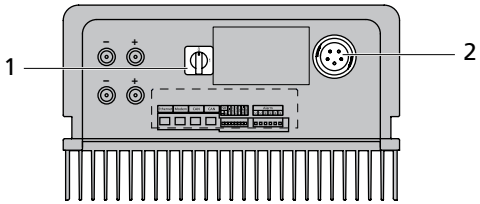
No consumers may be connected to the supply line from the solar inverter to the mains fuse.

Always separate the solar generator side first by quickly opening the DC load break switch and then the grid connection by switching off the corresponding mains fuse.

If the voltage on the AC connection exceeds the permissible value due to a long line length or an insufficient cable cross-section, the solar inverter will disconnected from the grid. In power grids with a low output and a high solar generator output, this can lead to individual solar inverters being switched off and then on again several times.

Survey

The grid connection of the solar inverter is made via an AC bayonet connector on the underside of the unit. With a 3-phase feed point (3-phase AC connection), a 5-wire connection (L1, L2, L3, N, PE) is used due to the 3-phase passive grid monitoring, while only a 3-wire connection (L1, N, PE) is used on the single-phase feed point. Feeding is always single-phase via AC terminal 2.



1 DC load break switch

2 AC connection

A corresponding circuit breaker is recommended as a line protection element in the grid feed direction:

AT 2700: 3 x 16 A

AT 3600: 3 x 25 A

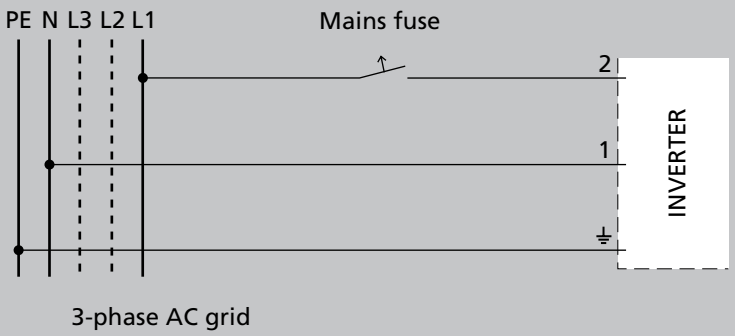
AT 4500: 3 x 25 A

AT 5000: 3 x 32 A

with slow-blow characteristic C

A three-pin circuit breaker in individual fuses can be used.

Terminal diagram



Depending on the grid operator and the feed point, a three-phase meter or a single-phase meter must be used.

Some grid operators require the use of a reverse-current-capable meter.

A basic distinction is made between two different connection options of the solar inverter to the public power grid:

- 3-phase AC grid
  (e.g. Germany)
- 1-phase AC grid (e.g. Italy, Spain)

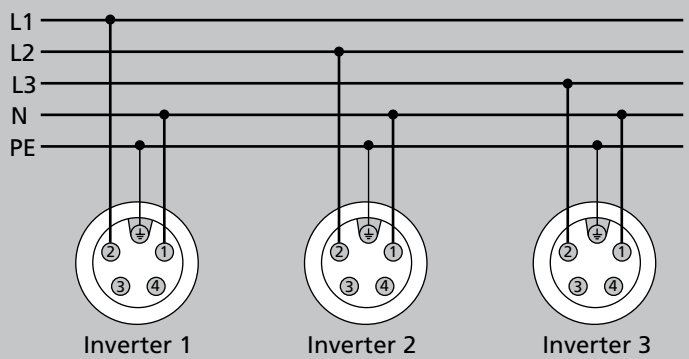
CAUTION

Observe the regional regulations for the grid connection.

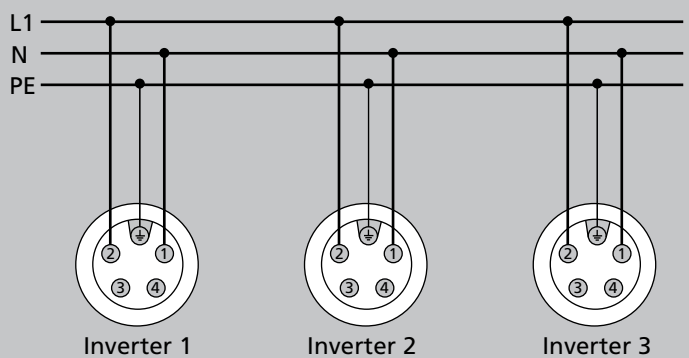
In Germany the grid connection must always be 3-phase!

The solar inverter always only feeds via AC terminal 2. If several solar inverters are operated in parallel in a 3-phase grid, AC terminal 2 of the unit must be distributed uniformly among the grid phases L1, L2 and L3 to avoid unequal loading.

3-phase grid connection (3-phase AC connection)



1-phase grid connection (AC connection)

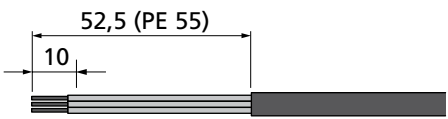


AC bayonet connector

The AC bayonet connector is permissible for cable sheath diameters from 13 mm to 20 mm.

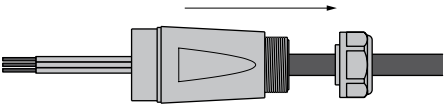
The following sequence must be observed during assembly:

1. Strip the voltage-free line and the cable ends.



For lines with a cable sheath diameter from 16 to 20 mm, the cable gland must be adapted accordingly. To do this, cut out the inner section of the blue sealing ring.

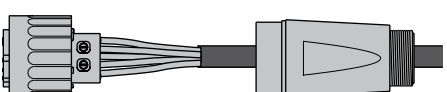
2. Slid the cable gland and the plug housing onto the line.



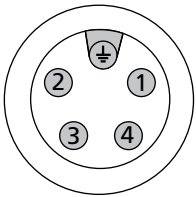
3. Connect the cable ends to the plug terminals in accordance with the pin assignment.
   Tightening torque: 0.7 Nm.

CAUTION

Observe the pin assignment of the AC bayonet connector. An incorrect assignment can result in the unit being destroyed.



Pin assignment



1 = N

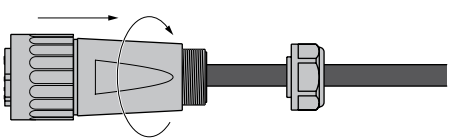
2 = L1 (feed-in phase)

3 = L2 (monitoring phase)

4 = L3 (monitoring phase)

⏚ = PE (protective earth conductor)

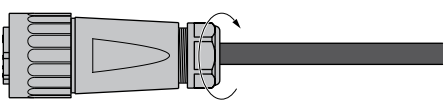
4. Screw plug housing to plug. To do this, press the outer ring of the plug toward the plug housing.
   Tightening torque: 1-2 Nm.



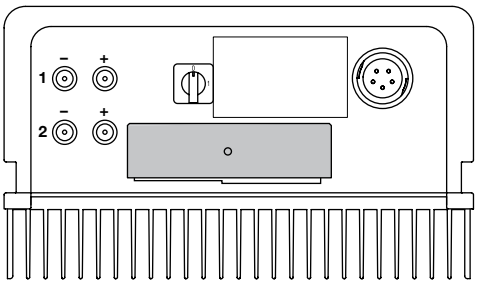
5. Tighten the cable gland.

Make sure the line is provided with a strain relief device. When using cables with a diameter < 16 mm, the line must be relieved just behind the connector.

Tightening torque for cable sheath diameters from
13 to 20 mm = 6 to 8 Nm



The interfaces are located behind the weatherproof connection box on the underside of the solar inverter.

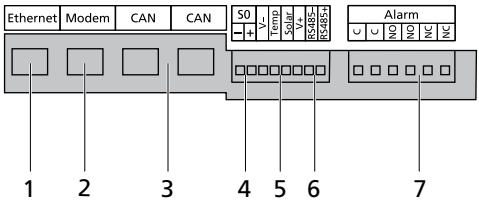


To open the connection box, loose the centre screw. Then carefully pull way the box toward the front.

After you have installed the connection cable, close the box again by guiding the locking hooks into the notches in the housing and then pressing the box onto the housing.

Retighten the mounting screw.

Interface overview



1 Ethernet connection

2 Modem connection

3 CAN bus

4 S0 interface (pulse output, e.g. for large display)

5 Connection for temperature and irradiation sensor

6 RS485 interface

7 Connection for alarm relay

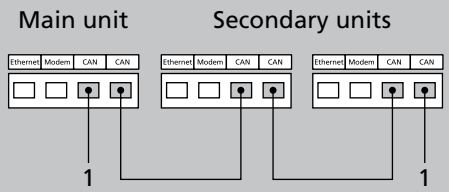
Networking solar inverters via CAN bus
The solar inverters can be networked with each other via the CAN bus interface.

Use the included Ethernet cable to network the solar inverters with each other.

One terminating resistor (1) must be on the first and last solar inverter in the series. The pluggable terminating resistors are contained in the delivery scope.

The total length of the CAN bus network may not exceed 100 m!

Networking via CAN bus



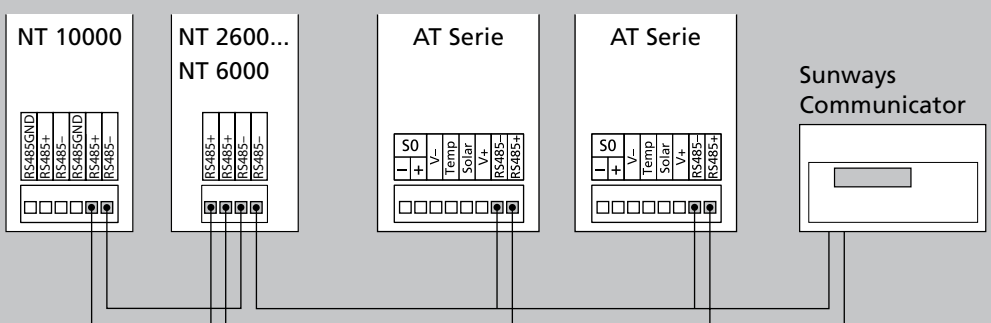
Networking solar inverters via RS485 interface

If you want to monitor a solar system with Sunways Solar Inverters both the NT series and the AT series together, then you can use the RS485 interface integrated in the solar inverters for this purpose. This function is supported from AT Communication Software Version 2.0002. If necessary, carry out a software update (see the chapter Software Update). The system networked with the RS485 interface can be monitored with the Sunways Communicator.

Use a twisted two-wire cable to network the solar inverters with each other.

Mount the terminating resistor on the last solar inverter.
NT 10000: **RS485MATCH** jumper,
NT 2600...NT 6000: **JP400** jumper

Networking via RS485 interface

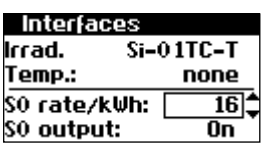


S0 interface

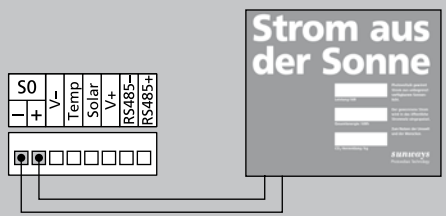
The S0 pulse output enables, for example, the connection of a large display (Sunways Display) for displaying the momentary output, the energy yields and the CO_2 reduction.

You can use the S0 interface on the main unit if you want to transmit the entire line yields as a sum to a large display.

The S0 interface is adjusted via the display on the inverter. Go to the menu «Settings – Network – Interfaces».



S0 interface with large display



Please note that the maximum pulse rate may not be greater than 15 pulses/sec. Calculate the pulse rate depending on the size of the solar system using the following formula:

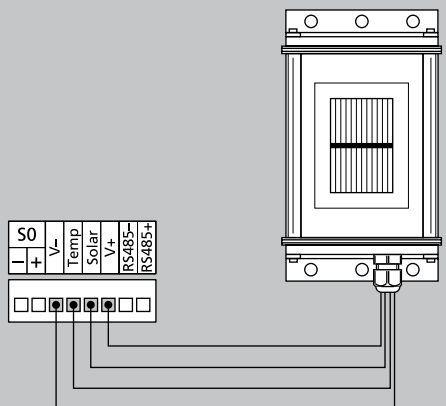
Pulse rate [pulses/kWh] = 50,000/system size [kWp]

The pulse rate must be set on your solar inverter and on the large display.

Connection of temperature and irradiation sensor

The optional addition of an irradiation sensor (model Si-01TC-K from Ingenieurbüro Mencke & Tegtmeyer) with an integrated PT-100 temperature sensor for temperature measurement enables the acquisition of irradiation data and the corresponding module temperature and storage in the internal data memory as a 5-minute mean value. This additional measuring unit helps analyse the system output. Based on the values, any errors on the PV generator, e.g. shading or failure of solar cells, can be detected.

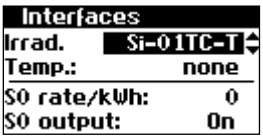
Temperature/irradiation sensor



Assignment of sensor connection

Pin assignment of plug sensor	Connection designation of sensor	Connection designation of solar inverter
Pin 1	Positive-signal irradiation strength	Solar
Pin 2	Positive-signal temperature	Temp
Pin 3	Reference earth	V-
Pin 4	Positive connection supply +5V	V+

The sensor is activated via the display. In the menu „Settings - Network - Interfaces“ you can select the sensor type in the «Irrad.» and «Temp.» field.



Connecting alarm relay

The solar inverters are equipped with a potential-free alarm relay as standard. The relay can be designed as a make-contact element or as a break-contact element and is actuated for all malfunctions signalled by the device. This ensures a faster, more reliable indication of a possible fault in the PV system on site. For PV systems with several solar inverters, the individual relays can be switched in parallel and connected via a common indicator lamp.

The main unit also signals faults from other units in the CAN network via the alarm relay. It is therefore sufficient for simple alerting to connect the alarm relay of the main unit.

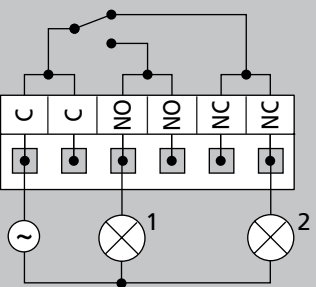
CAUTION

The connected signalling unit must be fused separately! The terminals are intended for a cable cross-section of 0.2 mm^2 to 1.5 mm^2.

When dimensioning the cross-section, also take the current consumption of the connected signalling unit into account!

The solar inverter is supplied by the feed-in phase from the AC grid. If the feed-in phase fails, then the alarm relay cannot switch, although a fault has occurred.

Wiring diagram of alarm relay - single unit



1 Indicator lamp, red

2 Indicator lamp, green

4.0 Commissioning

4.1 Connecting and disconnecting solar inverter

CAUTION

Ensure proper mechanical and electrical installation before commissioning the solar inverter.

Check the proper condition of the electrical lines.

Always separate the solar generator side first by quickly opening the DC load break switch and then the grid connection by switching off the corresponding mains fuse.

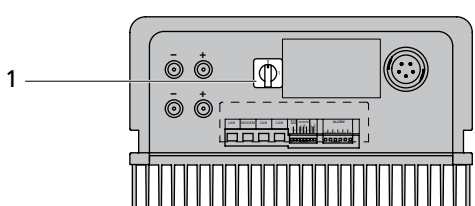
The Tyco Solarlok connectors of the solar generator connection may not be disconnected while under load. The DC load break switch must be quickly switched to the switching position 0.

The solar inverter is supplied from the grid. The solar inverter switches on automatically when sufficient solar generator output is available. Corresponding switch-on and switch-off thresholds have been defined for this purpose.

Connecting

1. Switch on the grid connection with the external circuit breakers.

2. Switch on the solar generator voltage by quickly closing the DC load break switch (switching position 1). The solar inverter takes up operation when sufficient input voltage is available.



1 DC load break switch

The operating LED lights up in accordance with the operating state.

The commissioning menu opens when the solar inverter is connected for the first time.

Switching off

1. Disconnect the solar generator side by quickly opening the DC load break switch (switching position 0)

2. Open the grid connection by switching off the circuit breaker.

The commissioning menu is automatically opened the first time the solar inverter is connected. It helps you make the standard settings.

For a better understanding of keyboard operation, please also see the chapter Operation.

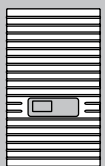
The commissioning of the solar inverter as

- a single unit
- a main unit and secondary units with several networked units

is described in detail in the following.

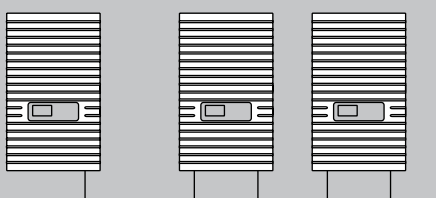
System with one solar inverter

Single unit



System with several solar inverters

Main unit Secondary units

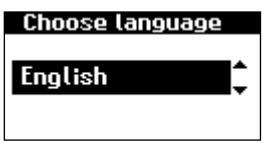


Commissioning single unit

1. During initial start-up the following appears on the display:

   Start commissioning with ok.

2. Select language in selection menu with ▲ / ▼.



   Confirm selected language with ok.

3. Select entry «Single device» in selection menu with ▲ / ▼.

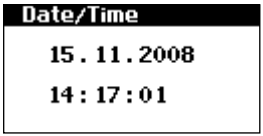
   Confirm with ok.

4. Set date and time.

Please note that time settings should only be made with caution, as they directly affect data logging. For example, if you set the time back by 1 hour, then the existing data will be overwritten.

   Select time with ok. Change selected number with ▲ / ▼ and jump to next number with ◀ / ▶.

Apply set time with ok and set date in same way as time.



Apply set date with ok.

5. Set password. Select password with ok.

   Default password is:

   * * * * * * * *

   A new password can be set with ▲ / ▼ / ◀ / ▶ as an option.

   Confirm password with ok.

6. Completion of commissioning

   Confirm overview with ok.

Commissioning several networked units

Before commissioning, all units must be interconnected via the CAN bus interface. See the chapter Networking solar inverters via CAN bus.

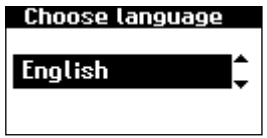
Switch on all units following installation. Commissioning begins with the main unit you have selected.

Commissioning main unit

1. During initial start-up the following appears on the display:

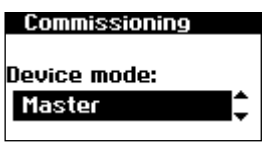
   Start commissioning of main unit with ok.

2. Select language in selection menu with ▲ / ▼.



   Confirm selected language with ok.

3. Select entry «Master» in selection menu with ▲ / ▼.



   Confirm with ok.

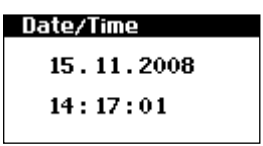
The other units in the CAN network are automatically configured as slaves.

4. Set data and time centrally for all connected units.

Please note that time settings should only be made with caution, as they directly affect data logging. For example, if you set the time back by 1 hour, then the existing data will be overwritten.

Select time with ok. Change selected number with ▲ / ▼ and jump to next number with ◀ / ▶.

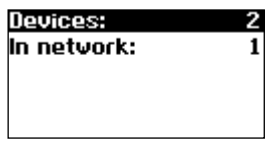
Apply set time with ok and set date in same way as time.



Apply set date with ok.

5. CAN network list is set up

Depending on the side of the network, it may take a moment until the main unit has found all secondary units and added them to the list.



Units = total number of devices found in CAN network
In network = number of configured units

After the main unit has found all connected secondary unit, these must be configured before commissioning of the main unit is continued.

Confirm with ok.

6. Set password. Select password with ok.

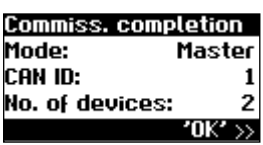
   Default password is:

   * * * * * * * *

   A new password can be set with ▲ / ▼ / ◀ / ▶ as an option.

   Confirm password with ok.

7. Completion of commissioning

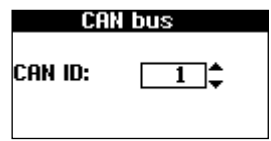


   Confirm overview with ok.

Commissioning secondary units

After a main unit has been defined, the display for requesting the CAN-ID is automatically shown on the display on each secondary unit.

1. Request CAN ID. Change to the editing mode with the ok. Request next highest free ID from main unit with ▲ or next lowest free ID with ▼.



   Confirm CAN-ID with ok.

With these IDs, the data of the individual secondary units can be assigned in the web interface and in the menu of the main unit.

The CAN-ID **1** is automatically assigned to the master. This means the slave can be assigned the IDs from **2 to 99**.

Commissioning cannot be continued until an ID has been requested from the main unit.

2. Completion of commissioning

Confirm overview with ok.

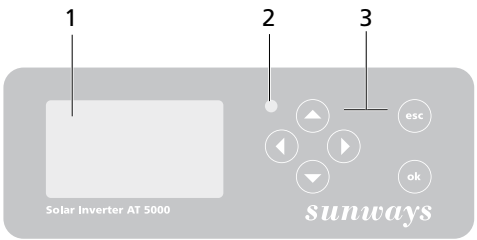
3. Carry out commissioning for all other slaves as described above.

Later commissioning

If you add new unit or replace existing ones in your solar system, then you can display the unit list in the display on the main unit under «Settings – Network – CAN bus». The new unit can them be put into operation in accordance with the description for commissioning secondary units.

5.0 Operation

Operating field
The solar inverter is operated via the operating field on the front.



1 LCD display (lighted)
2 Operating LED
3 Keyboard

LCD display
A graphics-capable, monochrome dot matrix display is integrated in the operating field. In standard operation the momentary output, daily yield and status are displayed. The bar graph shows the energy feed-in of the current day.
Press any key to activate the display lighting. If no key is pressed for approx.
1 minute, the display lighting goes out.

Important!
The LCD display is not a calibrated measuring device. It is characterised by a slight, system-dependent difference of a few percent.
Exact accounting of the data with the power supply company requires a calibrated meter.

Keyboard

The keyboard can be used to navigate in the menu, edit text fields, select entries from lists and enter numbers consecutively and digit by digit. User entries can only be made if the value to be changed is selected. The cursor changes visibly in the editing mode and indicates the digit to be changed.

key Scroll up.

key Scroll down.

key Select menu item.

key Back one menu level.

ok key Select menu item and confirm your entries.

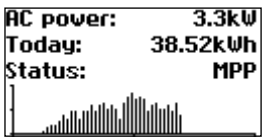
esc key Cancel.

Operating LED

The combined red/green LED indicates the unit status of the solar inverter:

- LED off
  Solar inverter is not active (night mode)
- LED green, continuously lit
  Solar inverter is active and feeds into power grid (MPP mode)
- LED green, flashing
  Solar inverter is active and feeds into power grid, however with current, output or temperature limitation.
- LED red, continuously lit
  an error has occurred (malfunction)
- LED red, flashing
  a warning has been issued

Standard screen (single unit)
The standard screen is always shown when no keyboard entry is made for more than 1 minute. It can also be shown manually with the menu item «Solar Inverter – Instantaneous Values».



The standard screen shows the most important data at a glance. In the first line you see the momentary feed-in power. In the second line the fed-in energy for the day is shown.

The status signals the unit status with the following messages:

MPP	Feeding in MPP mode
AC cur.lim.	Feeding with AC current limitation
DC cur.lim.	Feeding with DC current limitation
Temp.lim.	Feeding with temperature limitation
Output lim.	Feeding with output limitation
Feed.	Feeding
Warning	A warning has been output
Error	An error has occurred
Night	Night mode
Start	Initialisation phase of unit
COM-Upd	The communication software is being updated
DSP-Upd	The control software is being updated

The graphic in the lower section of the screen shows the energy fed in for the day as a bar graph. The current period is shown as a flashing bar, as it is still increasing.

Standard screen (system)

You can view the system data for a CAN-networked system with this screen.

Next to the total current system output, you also see the energy yield of your solar system and any status messages of all connected units. These are provided with the inverter number. An „M“ means that the error has occurred on the main unit.

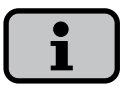
The various functions are accessed via the menu. The main menu is opened from the standard screen by pressing the ESC key twice.

You can always return to the standard screen by pressing and holding the ESC key.

If a status message is shown, then you can open the error list directly with the OK key.

You can access other instantaneous values from the standard screen with the Arrow down and Arrow up key.

Operation of the solar inverter is divided into various areas protected with passwords.
The password has 8 places.



If no entry is made with the keyboard after entering the password, it is necessary to reenter the password after approximately 5 minutes.

The password can be entered in the menu item «Settings – Login».

Customer area
The customer password must be entered to access this area. All settings can be made which are required for installation and commissioning of the solar inverter.

The password for the customer area is:

* * * * * * * *

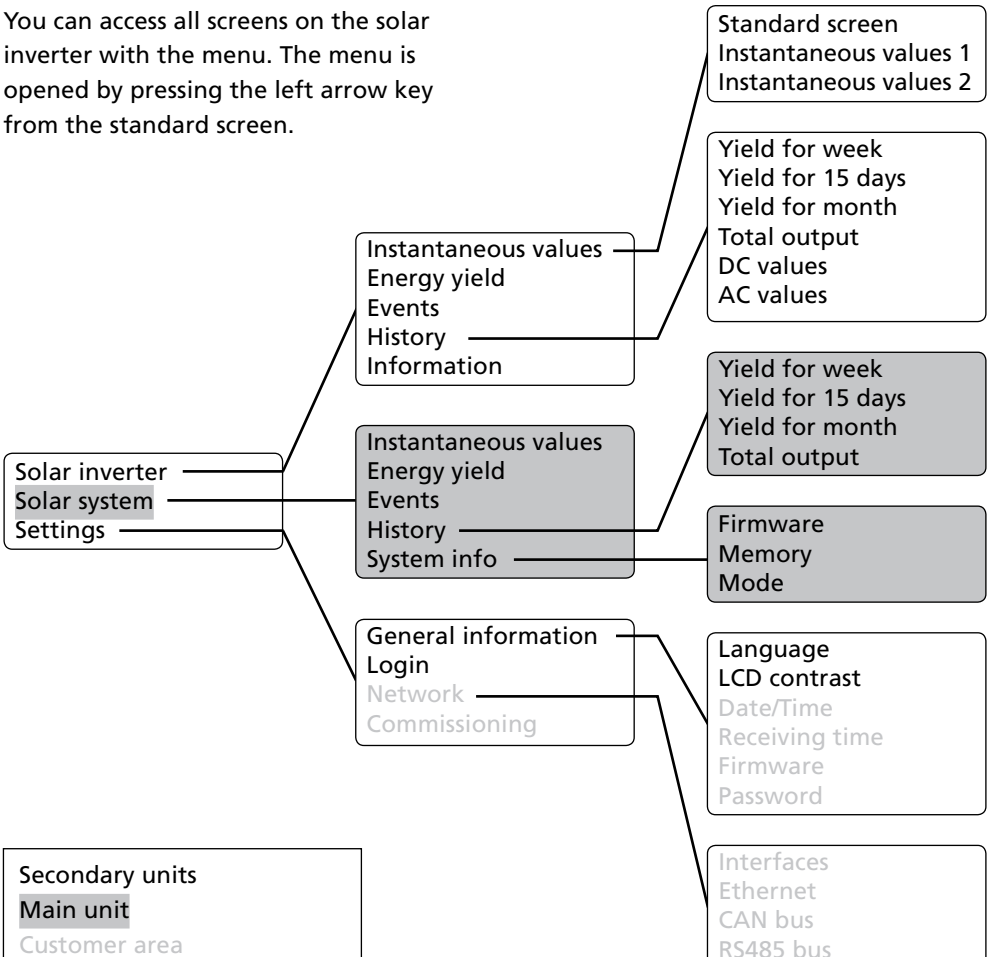
The password is preset and is directly confirmed with ok.

As an option you can assign a personal password in the Commissioning menu.

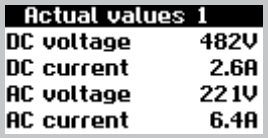
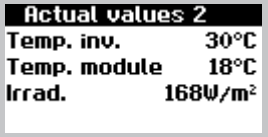
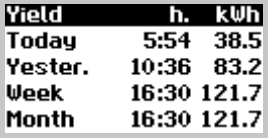
Installer area
In this area the installer can make special settings on the solar inverter which are possible after consulting the technical hotline.
A device-dependent password must be requested from the technical hotline.

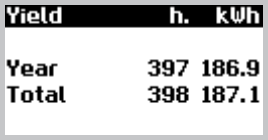
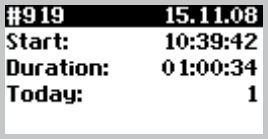
Technical Hotline +49-7531-99677577

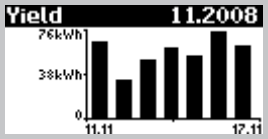
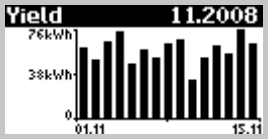
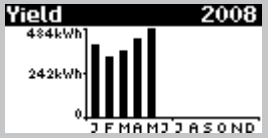
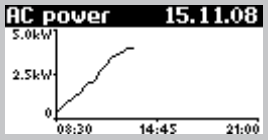
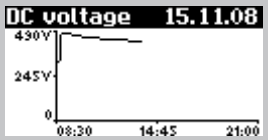
You can access all screens on the solar inverter with the menu. The menu is opened by pressing the left arrow key from the standard screen.

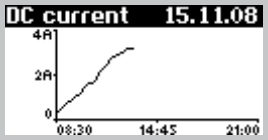
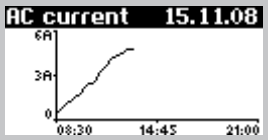
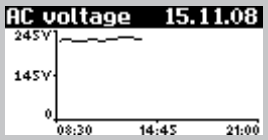


5.4 Overview of screen displays

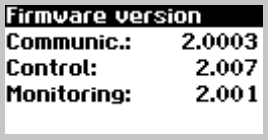
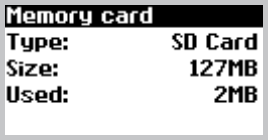
Display	Description	Calling Menu
Instantaneous Values – Unit		
	Current feed-in power, daily energy yield and unit status MPP Feeding in MPP mode	The screen appears automatically when you have not made any entries with the keyboard for several minutes. Solar inverter – Instantaneous values
	Display of voltages and currents from solar generator and grid	Solar inverter – Instantaneous values – ⊛
	Interior temperature of unit (Temp.Inv.) and temperature and irradiation values (if sensor is connected)	Solar inverter – Instantaneous values – ⊛
	AC yields and operating hours from today, yesterday, week and month	Solar inverter – Energy yield

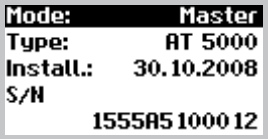
	AC yields and operating hours from year and total value	Solar inverter – Energy yield – ▼
Events – Unit		
	Select starting data for event display	Solar inverter – Events
	Display event list	Solar inverter – Events – ok
	Display event details (error number, data, starting time, duration and number of occurrences per day)	Solar inverter – Events – ok – ok

History – Unit		
	Daily yield for 1 week	Solar inverter – History – Yield for week
	Daily yields for 15 days	Solar inverter – History – Yield for 15 days
	Monthly yields	Solar inverter – History – Yield for month
	AC output (5-min. values)	Solar inverter – History – AC output
	DC voltage (5-min. values)	Solar inverter – History – DC output

	DC current (5-min. values)	Solar inverter – History – DC values – ⊛
	AC current (5-min. values)	Solar inverter – History – AC values
	AC voltage (5-min. values)	Solar inverter – History – AC values – ⊛

Information – Unit

	Firmware	Solar inverter – Information – Firmware
	Memory card	Solar inverter – Information – Memory

	Device mode	Solar inverter – Information – Mode

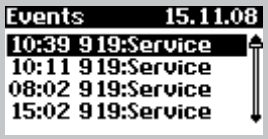
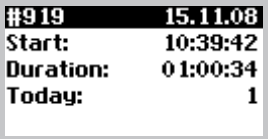
Instantaneous values – Solar system (only on main unit)

	Current system feed-in power, daily energy yield and system status	The screen appears on the main unit automatically when you do not make any entries with the keyboard for several minutes. Solar system – Instantaneous values

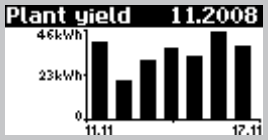
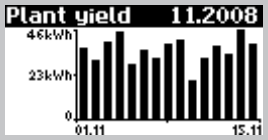
Yields – Solar system (only on main unit)

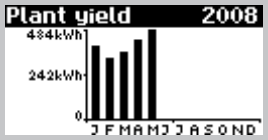
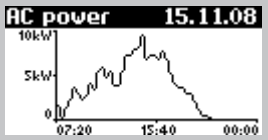
	AC system yields and operating hours from today, yesterday, week and month	Solar system – Energy yield
	AC system yields and operating hours from year and total value	Solar system – Energy yield – ⊛

Events – Solar system (only on main unit)

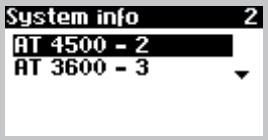
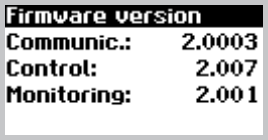
	Select starting data for system event display	Solar system – Events
	Display event list for entire system	Solar system – Events – ok
	Display event details (error number, data, starting time, duration and number of occurrences per day)	Solar system – Events – Enter – Enter – ok – ok

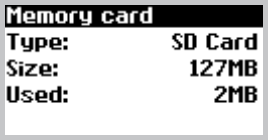
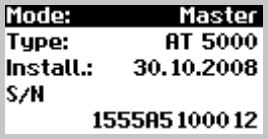
History – Solar system (only on main unit)

	Solar system daily yield for 1 week	Solar system – History – Yield for week
	Solar system daily yield for 15 days	Solar system – History – Yield for 15 days

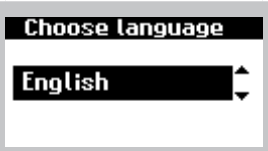
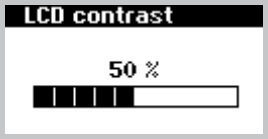
	Solar system monthly yields	Solar system – History – Yield for month
	Solar system AC output (5-min. values)	Solar system – History – AC output

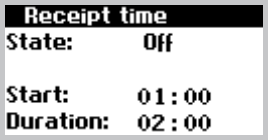
System info – Solar system (only on main unit)

	Unit list for selecting a unit	Solar system – System info
	Selection of information	Solar system – System info – ok
	Firmware	Solar system – System info – Firmware

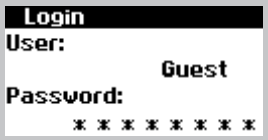
	Memory card	Solar system – System info – Memory
	Device mode	Solar system – System info – Mode

Settings – General

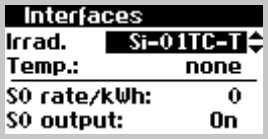
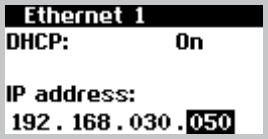
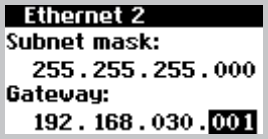
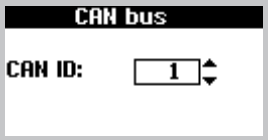
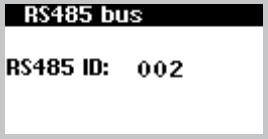
	Display language	Settings – General – Language
	LCD contrast	Settings – General – LCD contrast
	Set date/time (only possible with customer password)	Settings – General – Date/Time

	Set receiving time (starting time and duration in which the unit can also be addressed in the night mode via the network). (only possible with customer password)	Settings – General – Receiving time
	Changing the customer password (only possible with customer password)	Settings – General – Password

Settings – Login

	Password entry to access advanced settings (necessary for commissioning)	Settings – Login

Settings – Network (only possible with customer password)

	Setting of the irradiation and temperature sensor and configuration of the S0 pulse output	Settings – Network – Interfaces
	Network settings (Screen 1): Activate DHCP for the automatic IP address setting or enter IP address manually	Settings – Network – Ethernet
	Network settings (Screen 2):	Settings – Network – Ethernet – ⊛
	Have CAN bus ID assigned by the main unit	Settings – Network – CAN bus
	Assign RS485 address to the unit (only necessary if NT units are connected in the network)	Settings – Network – RS485 bus

5.4 Malfunction displays

The solar inverter indicates malfunctions in the LCD display and saves these in the internal error memory.

The malfunction display consists of a number and a short designation. Based on the first number you can quickly recognise which area the error has occurred in:

1: Error in the area of the solar generator

2: Error in the area of the AC network

3: Error in the area of the inverter

4: Error in the area of the interfaces/communication

9: Service error

If an error is shown in the standard display, then you can look up the exact error message in the menu under «Solar inverter – Events».

You can look up the malfunction causes yourself using the following list. First select the malfunction which has occurred and then read under Remedies what you can do to eliminate the malfunction.

Malfunction	Description	Remedies
101:U-DC max	Your AT solar inverter is approved for a maximum open-circuit voltage of the solar generator of 680 V. All components of the DC input are sufficiently dimensioned with a safety factor. If the threshold is exceeded, the solar inverter stops feeding.	The maximum DC voltage was exceeded. ➡ Check the dimensioning of your PV generator. Too many modules are connected in series. ➡ Reduce the number of modules and carry out commissioning again.
102:Insulation	Before each connection, your solar inverter checks the PV system for a possible earth fault or insulation faults. Should this kind of error be detected, no feeding takes place. The mode of operation is conformant with DIN VDE 0126-1-1.	The solar inverter has discovered an insulation fault in the PV system during start-up. ➡ Check your PV system for possible insulation faults (pinched-off DC lines etc). The measured insulation resistance must be at least 680 kohms.

Malfunction	Description	Remedies
103:AFI>30mA	Your solar inverter is equipped with a universally sensitive AFI according to DIN VDE 0126-1-1. This monitoring unit has detected a relative residual current jump of >30 mA.	A residual current jump has occurred during operation of the solar inverter. ➡ Check your PV system for possible insulation faults.
104:AFI>0.3A	Your solar inverter is equipped with a universally sensitive AFI according to DIN VDE 0126-1-1. This monitoring unit has detected an absolute residual current of >300 mA.	A residual current greater than 300 mA has occurred during operation of the solar inverter. ➡ Check your PV system for possible insulation faults.
201:Surgef.	Your solar inverter continually monitors the quality of the AC grid. During high voltage peaks on the phase feeding in, the solar inverter stops feeding and attempts a restart.	The solar inverter has detected a high voltage peak on the phase feeding in. ➡ After malfunction elimination the solar inverter restarts automatically. Should the error occur frequently, please contact your power supply company. A monitoring phase and a directly earthed conductor were exchanged when connecting the AC side.

Malfunction	Description	Remedies
202:UAC1>10%	If the voltage of the phase feeding in was greater than 253 V for a period of ten minutes, the solar inverter stops feeding and attempts to switch on again when the grid voltage is within the permissible range. The mode of operation is conformant with DIN VDE 0126-1-1.	The cable cross-section in the AC supply line to the solar inverter is too small. Your inverter feeds into a spur line, which is insufficiently dimensioned. ➡ Check the design of your grid connection (energy meter) or the grid feed point to your Electric Utility. ➡ Ask your Electric Utility about grid stability and design.

Malfunction	Description	Remedies
203:UCA1>15%	Your solar inverter continually monitors the voltage level of the phase feeding in. When the maximum permissible limit is exceeded, the solar inverter stops feeding and does not start up again until the voltage value drops below the maximum permissible limit.	The cable cross-section in the AC supply line to the solar inverter is too small. Your inverter feeds into a spur line, which is insufficiently dimensioned. ➡ Check the design of your grid connection (energy meter) or the grid feed point to your Electric Utility. ➡ Ask your Electric Utility about grid stability and design.

Malfunction	Description	Remedies
204:UAC1<Min	Your solar inverter continually monitors the voltage level of the phase feeding in. When the minimum permissible limit is dropped below, the solar inverter stops feeding and does not start up again until the voltage value exceeds the minimum permissible limit. If the voltage drops below 160 V, the solar inverter cannot be supplied.	➡ Ask your Electric Utility about grid stability and design.
205:UAC2>Max	Your solar inverter is equipped with a three-phase voltage monitoring function according to DIN VDE 0126-1-1. It constantly monitors the voltage level of the individual phases (here: L2). When the maximum permissible limit is exceeded, the solar inverter stops feeding and does not start up again until the voltage value drops below the maximum permissible limit.	➡ Ask your Electric Utility about grid stability and design.

Malfunction	Description	Remedies
206:UAC2<Min	Your solar inverter is equipped with a three-phase voltage monitoring function according to DIN VDE 0126-1-1. It constantly monitors the voltage level of the individual phases (here: L2). When the minimum permissible limit is dropped below, the solar inverter stops feeding and does not start up again until the voltage value exceeds the minimum permissible limit.	➡ Ask your Electric Utility about grid stability and design.
207:UAC3>Max	Your solar inverter is equipped with a three-phase voltage monitoring function according to DIN VDE 0126-1-1. It constantly monitors the voltage level of the individual phases (here: L3). When the maximum permissible limit is exceeded, the solar inverter stops feeding and does not start up again until the voltage value drops below the maximum permissible limit.	➡ Ask your Electric Utility about grid stability and design.

Malfunction	Description	Remedies
208:UAC3<Min	Your solar inverter is equipped with a three-phase voltage monitoring function according to DIN VDE 0126-1-1. It constantly monitors the voltage level of the individual phases (here: L3). When the minimum permissible limit is dropped below, the solar inverter stops feeding and does not start up again until the voltage value exceeds the minimum permissible limit.	➡ Ask your Electric Utility about grid stability and design.
209:Isol.op.	You solar inverter is equipped with a high-quality redundant grid monitoring function according to DIN VDE 0126-1-1 and constantly monitors the grid. If one of the phases fails, or if the phase position between the individual conductors changes, the solar inverter stops feeding and does not start up again until the error is eliminated.	➡ Check the phases L2 and L3. ➡ Ask your Electric Utility about grid stability and design.

Malfunction	Description	Remedies
210:Frq1>Max	The solar inverter continually monitors the grid frequency of the phase feeding in. If this lies above the permissible value, the solar inverter stops feeding and does not start up again until the value is below the limit.	➡ Ask your Electric Utility about grid stability and design.
211:Frq1<Min	The solar inverter continually monitors the grid frequency of the phase feeding in. If this lies below the permissible value, the solar inverter stops feeding and does not start up again until the value is above the limit.	➡ Ask your Electric Utility about grid stability and design.

Malfunction	Description	Remedies
212:DC share	Your solar inverter continually monitors the quality of current fed in. If an increased DC share is found in the current fed in, the solar inverter stops feeding. The solar inverter does not attempt to feed in again until after a reset (the next day).	➡ Restart the solar inverter. If the error still occurs, please contact the technical hotline. The phone number is provided on the back of the manual.
213:UAC1>10% (Warning)	The voltage of the phase feeding in is higher than 10% above the nominal value. If this is the case for longer than ten minutes, the inverter stops feeding and does not switch on again until the voltage drops below this limit again.	The cable cross-section in the AC supply line to the solar inverter is too small. Your PV system feeds into a spur line, which is insufficiently dimensioned. ➡ Ask your power supply company (PSC) about grid stability and design. ➡ Check the design of your grid connection (energy meter) or the grid feed point to your Electric Utility.

Malfunction	Description	Remedies
301:AFI-Over	The integrated sensor for measuring the residual current has been operated outside its measuring range.	A residual current was detected during start-up. ➡ Restart the solar inverter. If the error still occurs, please contact the technical hotline. The phone number is provided on the back of the manual.
302:Monit.	The AT solar inverter is equipped with a redundant monitoring unit which constantly checks the measured values of the controller for plausibility. If a deviation or an error is detected in the process, this message appears. In addition, this message can also appear in case of a power failure.	➡ Restart the solar inverter. If the error still occurs, please contact the technical hotline. The phone number is provided on the back of the manual.

Malfunction	Description	Remedies
303:Overtmp.	Your solar inverter is designed for an ambient temperature of up to +40°C. When a specified temperature threshold of the heat sink is reached, the output power is reduced linearly. Should the heat sink temperature nevertheless continue to increase, feeding is stopped. After the heat sink temperature drops, the solar inverter starts up again automatically.	The maximum permissible ambient temperature has been exceeded. ➡ The installation location is not suitable. Please find another installation location. The necessary air circulation was not taken into account during installation. ➡ Clean the solar inverter, if dirt prevents cooling. ➡ Observe the installation distances specified in the manual. Objects were laid on the heat sink and unimpaired convection was prevented. ➡ Remove the objects.

Malfunction	Description	Remedies
304:Mains rel.	The AT solar inverter checks the operation of the mains relay prior to every switch-on. An error was detected during this check.	➡ Restart the solar inverter. If the error still occurs, please contact the technical hotline. The phone number is provided on the back of the manual.
305:AFI Test	The AT solar inverter checks the operation of its residual-current monitoring unit prior to every switch-on. An error was detected during this check.	➡ Restart the solar inverter. If the error still occurs, please contact the technical hotline. The phone number is provided on the back of the manual.

Malfunction	Description	Remedies
306:Temp mea.	The AT solar inverter is equipped with a temperature sensor that monitors the heat sink temperature. This message appears if the sensor reports a value outside its value range or in case of a sensor cable break.	The ambient temperature of the solar inverter is outside the permissible range (< -25°C). ➡ Wait until the temperature reaches the permissible operating range. A cable break has occurred in the sensor which monitors the heat sink temperature. ➡ Please contact the technical hotline. The phone number is provided on the back of the manual.

Malfunction	Description	Remedies
307:Overtmp. (Warning)	Your solar inverter is designed for an ambient temperature of up to +40°C. When a specified temperature threshold of the heat sink is reached, the output power is reduced linearly. Should the heat sink temperature nevertheless continue to increase, feeding is stopped. This warning appears when the current heat sink temperature is just below the switch-off threshold.	The maximum permissible ambient temperature has been exceeded. ➡ The installation location is not suitable. Please find another installation location. The necessary air circulation was not taken into account during installation. ➡ Clean the solar inverter, if dirt prevents cooling. ➡ Observe the installation distances specified in the manual. Objects were laid on the heat sink and unimpaired convection was prevented. ➡ Remove the objects.

Malfunction	Description	Remedies
401:SD Card	The solar inverter cannot find an SD card.	➥ Restart the solar inverter. If the error still occurs, please contact the technical hotline. The phone number is provided on the back of the manual.
402:SD Card	The SD card is write-protected	➥ Restart the solar inverter. If the error still occurs, please contact the technical hotline. The phone number is provided on the back of the manual.
403:CAN User	Communication error with CAN user.	➥ Check whether an error has occurred in the CAN secondary unit. Restart secondary unit and main unit if necessary.

Malfunction	Description	Remedies
404:CAN Bus	CAN bus not in operation.	No communication is possible via the CAN bus. ➡ Check the bus lines and the terminating resistors. ➡ Check whether the maximum permissible line lengths have been complied with. ➡ Check whether the bus lines have been routed parallel to power cables. Separate bus lines and power cable from each other spatially if necessary.
405:CAN User	CAN user does not respond.	➡ Check whether an error has occurred in the CAN secondary unit. Restart secondary unit if necessary.

Malfunction	Description	Remedies
406:Solar (Warning)	No sensor found on sensor channel 1 (solar).	If you have connected a sensor: ➡ Check the connection to your sensor. If you have not connected a sensor: ➡ Check the configuration with the Sunways Browser.
407:Temp. (Warning)	No sensor found on sensor channel 2 (temperature).	If you have connected a sensor: ➡ Check the connection to your sensor. If you have not connected a sensor: ➡ Check the configuration with the Sunways Browser.

Malfunction	Description	Remedies
408:CAN Comm (Warning)	Communication malfunctions occur repeatedly on the CAN bus.	A malfunction occurs in the data transmission on the CAN bus. However, a data exchange continues to be possible. ➡ Check whether all connectors of the bus lines and the terminating resistors are properly mounted. ➡ Check whether the bus lines have been routed parallel to power cables. Separate bus lines and power cable from each other spatially if necessary.
409:CAN Conf. (Warning)	CAN bus is in the configuration mode. No measured values are transferred.	At least one unit is in the menu item «Settings – Network – CAN bus». ➡ Close this menu for all units.

Malfunction	Description	Remedies
410:SMTP Co.	SMTP server cannot be reached	Check the Email settings with the Sunways Browser. ➡ Is a valid URL or IP address set for the SMTP server?
411:SMTP Soc	SMTP no socket available	Internal error or problem when addressing the server: no remedy available
412:SMTP Co.	SMTP faulty communication with server	Check the Email settings with the Sunways Browser. ➡ Is a valid recipient Email address set? ➡ Is the portal Email address set to sunways@mail1.meteocontrol.de in the configuration of the system monitoring?

Malfunction	Description	Remedies
413:DNS Fail.	DNS has failed	Check whether a valid gateway and a valid DNS server IP address are entered in the network configuration. ➡ Can the inverter access the Internet?
414:HTTP Con.	HTTP client connection has failed	Check the settings of the portal address (www.meteocontrol.de) and the mailbox file (extern/sunways/pobox.php) in the configuration of the system monitoring
415:HTTP Aut.	HTTP client authorisation has failed	Internal error or problem when addressing the server: no remedy available
416:HTTP Tim.	HTTP client timeout	Internal error or problem when addressing the server: no remedy available
417:HTTP Soc.	HTTP client no socket available	Internal error or problem when addressing the server: no remedy available

Malfunction	Description	Remedies
418:HTTP Soc.	HTTP client error with socket	Internal error or problem when addressing the server: no remedy available
419:HTTP Met.	HTTP client incorrect method	Internal error or problem when addressing the server: no remedy available
420:HTTP Pro.	HTTP client error with protocol	Internal error or problem when addressing the server: no remedy available
421:HTTP Wri.	HTTP client write error	Internal error or problem when addressing the server: no remedy available
422:HTTP Rea.	HTTP client read error	Internal error or problem when addressing the server: no remedy available

Malfunction	Description	Remedies
9xx: Service	A service error has occurred.	➡ Disconnect the solar inverter from the grid and from the solar generator and reconnect it. If the error occurs again, please contact the technical hotline. The phone number is provided on the back of the manual.

6.0 System monitoring

The basis for the system monitoring is the data logger integrated in the AT solar inverter. The solar inverters of the AT series are equipped with a broad range of monitoring options for your solar system:

- The Sunways Browser offers the display of instantaneous values, stored operating data and settings
- With active alerting the main unit can send errors which have occurred in the solar system to a selected recipient by Email.
- With the Sunways Portal connection the AT solar inverter can send the operating data of your solar system to the Sunways Portal daily without additional hardware. This enables you to track your yields via the Internet.

One of the four possible connections between a PC and the solar inverter is possible for this purpose:

- Direct connection via an Ethernet cable
- Connection via an existing Ethernet network
- Connection via the Internet, e.g. connection of the solar inverter to a DSL connection
- Connection via the Sunways Modem

6.2 Integrated data logger

The integrated data logger of the AT solar inverter stores the operating data of your solar system. In addition to 5-minute mean values, energy yields are also stored as 5-minute, daily, weekly, monthly and annual values. Up to 200 status changes (warnings and errors with start and end) are also stored. Each data record contains the data and time. The data logger is designed as a circulating memory, i.e. the respective oldest data are overwritten with new data.

Operating Data (5-Min. Mean Values)

Qty.	Value
2000	DC current
2000	DC voltage
2000	AC current
2000	AC voltage
2000	AC output
2000	Unit temperature
2000	Module irradiation (opt.)
2000	Module temperature (opt.)

Energy Yields

Qty.	Value
2000	5-minute yield
800	Daily yield
800	Weekly yield
250	Monthly yield
20	Annual yield

Status Messages

Qty.	Value
200	Status changes

6.3 Direct Ethernet connection

The solar inverters are equipped with an Ethernet interface as standard for system monitoring and configuration with a PC.

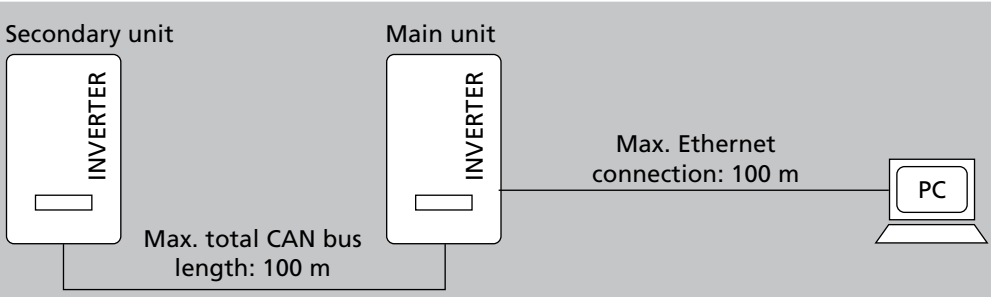
Connect your PC and the solar inverter with a crossed or 1:1 Ethernet connection cable of the type CAT5 with RJ45 sockets (automatic detection) or with the included Ethernet cable.

The PC is connected to the main unit as standard.

To always find the suitable configuration for installation and commissioning on the PC, we recommend the use of a second network card (e.g. PCBus, PCMCIA), which you can configure to match the default setting of the solar inverter.

The PC and the solar inverter must have suitable IP addresses and net masks. The network settings can be adjusted wither directly on the solar inverter via the LCD display or on your PC.

Direct Ethernet connection



The solar inverter is supplied with the following, preset IP address:

192.168.30.50

On request you can assign your own IP address to the solar inverter via the menu «Settings».

In the default setting the solar inverter does not support a DHCP (Dynamic Host Configuration Protocol). Therefore, no automatic assignment of the IP address takes place. It is possible to activate the DHCP protocol via the menu «Settings».

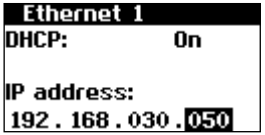
IP addresses may not be assigned twice within the network!

1. Open the menu «Settings – Login».

2. Enter the default password (********) or the password you have assigned here.

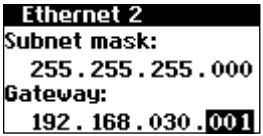
3. Open the menu «Settings – Network – Ethernet».

4. Enter an IP address suitable for use with your PC. This means the first three number blocks must be identical, and the last number block different.



Example:
If your PC has the IP address 192.168.1.1, then you assign the solar inverter the IP address 192.168.1.2

5. Call up additional settings with .



6. Enter the subnet mask **255.255.255.0** here.

7. Enter the IP address of your PC in the gateway.

8. Confirm this entry with .

After the network configuration is completed you can start the Sunways Browser by entering the IP address of the solar inverter in the address line of your web browser.

6.5 Network settings on PC

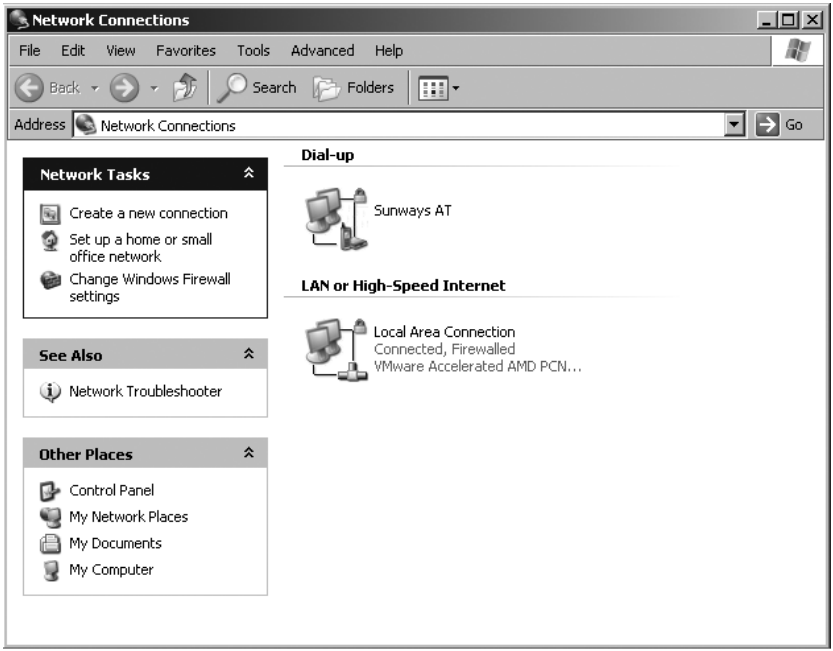
To enable your PC to communicate with the solar inverter, you must make network settings. The procedure differs slightly depending on the operating system. An example of the configuration under Windows®XP is shown in the following.

IP addresses may not be assigned twice within the network!

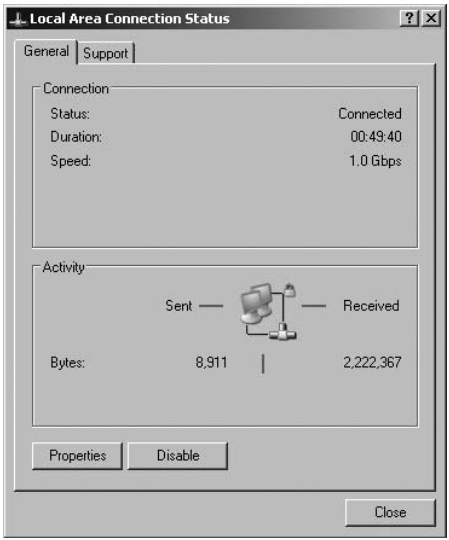
1. Select «Start - Settings».

2. Select «Network Connections».

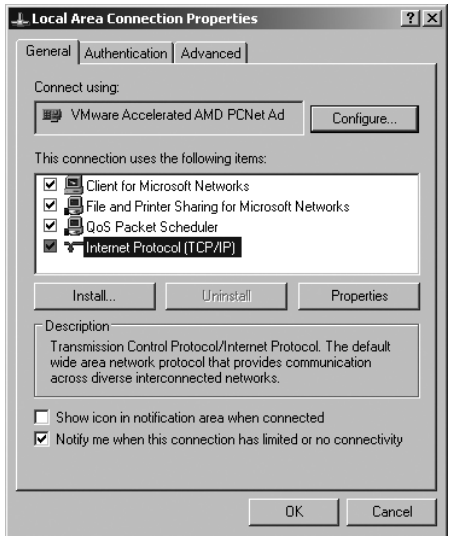
3. Double-click on the LAN connection via which you are connected to the solar inverter.



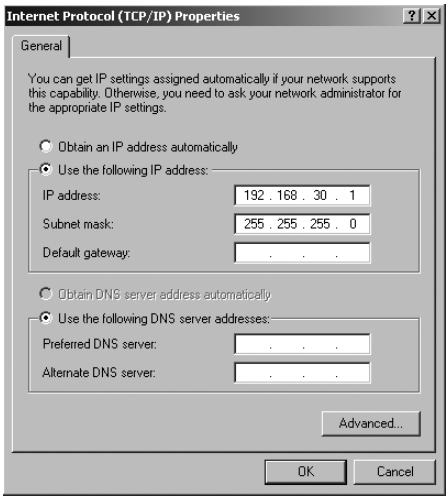
4. Click in the Status window on «Properties».



5. Mark «Internet Protocol (TCP/IP)» and click on «Properties» again.

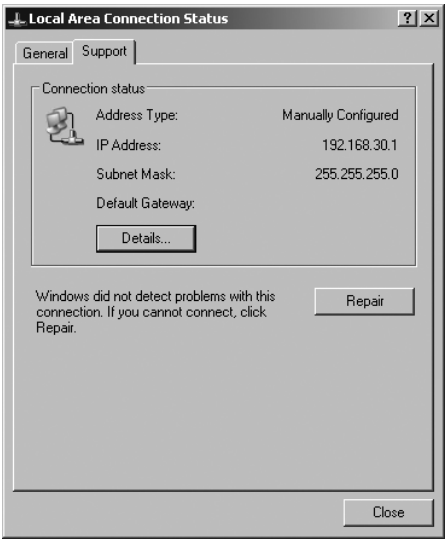


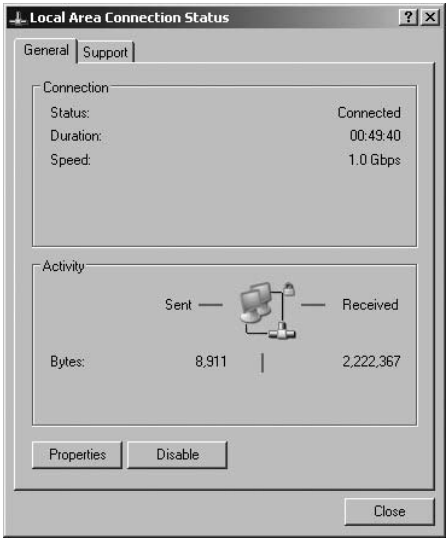
6. Now assign an unused IP address **192.168.30.XXX** and enter the subnet mask **255.255.255.0**.


Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address: 192 . 168 . 30 . 1
Subnet mask: 255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

7. Click on «OK» to confirm your entries.

8. In the menu item «Status» you can check the correctness of your entries and the status of your connection





After the network configuration is completed you can start the Sunways Browser by entering the IP address of the solar inverter in the address line of your web browser.

For more complex network configurations, please contact your network administrator.

6.6 Connection via an existing Ethernet network

If a home or company network exists, then you can integrate the AT solar inverter directly in the network as a network user.

Connect your PC and the solar inverter with a CAT5 Ethernet cable with RJ45 sockets 1:1 for a hub, or crossed for a switch.

The main unit is connected to the network as standard.

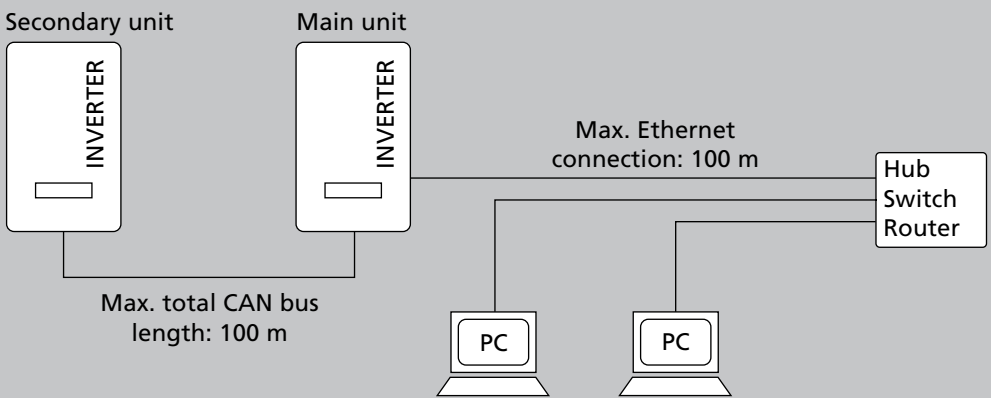
With DHCP
If a DHCP server is present in your network, you can activate DHCP on the solar inverter. In this case the solar inverter obtains the network settings automatically. You can display the assigned IP address via the LCD display (menu «Settings – Network – Ethernet»).

Without DHCP
If there is no DHCP server in your network, you must set an IP address still not used in the network on the AT solar inverter (see the chapter Network setting on solar inverter).

Ask your network administrator for the necessary settings for IP address, net mask and gateway.

After the network configuration is completed you can start the Sunways Browser by entering the IP address of the solar inverter in the address line of your web browser.

Connection via Ethernet network



6.7 Connection via Internet

If a DSL connection or a network with Internet access exists, then you can make the solar inverter reachable via the Internet.

Requirement:
Your DSL modem or Internet router supports static IP address services,
e.g. www.dyndns.org

1. For this purpose, connect your solar inverter to your DSL router, DSL modem, switch or hub depending on the network structure. Use a CAT5 Ethernet cable with RJ45 sockets 1:1 for a hub, or crossed for a switch.
   The main unit is connected to the network as standard.

2. Register free of charge, e.g. at www.dyndns.org.

3. Create a so-called alias for the access to your solar inverter, e.g. at-sunways.dyndns.org. You can access your solar inverter later via this address.

4. Configure your DSL modem or Internet router so that the IP address is regularly reported to www.dyndns.org (follow the procedure in the manual of your DSL modem or Internet router for this purpose).

5. Configure your DSL modem or Internet router so that, for example, it accepts requests from the Internet via Port 80 and forwards them internally to the solar inverter (Port Forwarding).

6. Also note that the port for accesses from the Internet set in your firewall must be released.

Sunways AG provides instructions for the configuration of frequently used DSL modems on the web site.

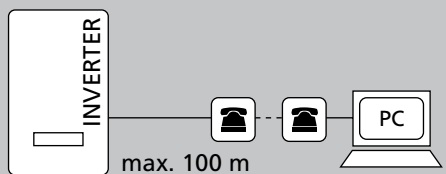
6.8 Connection via Sunways Modem

A modem connection can be used to bridge longer distances during system monitoring and configuration. The Sunways Modem is connected to the solar inverter for this purpose. The Sunways Modem can be used as an analogue, ISDN and GSM modem.

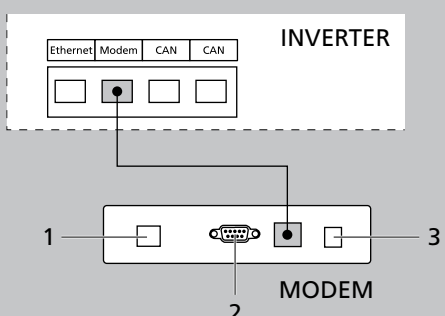
1. Connect your solar inverter and the remote modem with a crossed or 1:1 Ethernet connection cable of the type CAT5 with RJ45 sockets. The main unit is connected to the remote modem as standard.

2. Connect an external modem to your PC or, if available, use the internal modem of the PC. For commissioning, please read the user manual of the Sunways Modem.

Modem connection



Connecting Sunways Modem



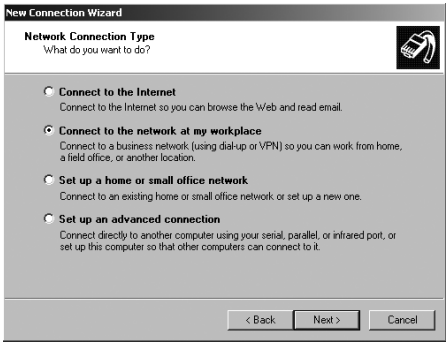
1 Telephone connection
2 RS232 interface
3 Power supply unit

6.9 Dialling in from a PC to solar inverter

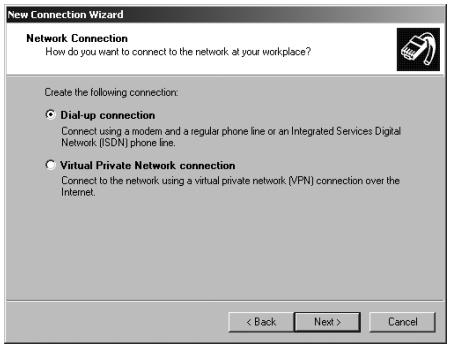
To establish a connection to your solar inverter with a PC via the modem, you must establish a dial-up connection in Windows. The procedure under Windows®XP is shown in the following.

1. Run the wizard for a new connection with «Start – Settings – Network Connections».
   The first selection screen is opened with «Continue».

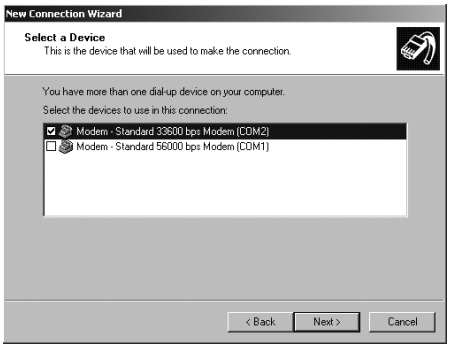
2. Select «Connection to the network on My Computer».


New Connection Wizard
Network Connection Type
What do you want to do?
Connect to the Internet
Connect to the Internet so you can browse the Web and read email.
Connect to the network at my workplace
Connect to a business network (using dial-up or VPN) so you can work from home, a field office, or another location.
Set up a home or small office network
Connect to an existing home or small office network or set up a new one.
Set up an advanced connection
Connect directly to another computer using your serial, parallel, or infrared port, or set up this computer so that other computers can connect to it.
< Back
Next >
Cancel

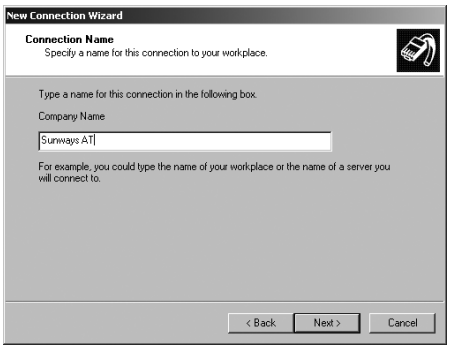
3. Confirm your selection with «Continue» and select «Dial-up connection» on the next screen and confirm with «Continue».


New Connection Wizard
Network Connection
How do you want to connect to the network at your workplace?
Create the following connection:
Dial-up connection
Connect using a modem and a regular phone line or an Integrated Services Digital Network (ISDN) phone line.
Virtual Private Network connection
Connect to the network using a virtual private network (VPN) connection over the Internet.
< Back
Next >
Cancel

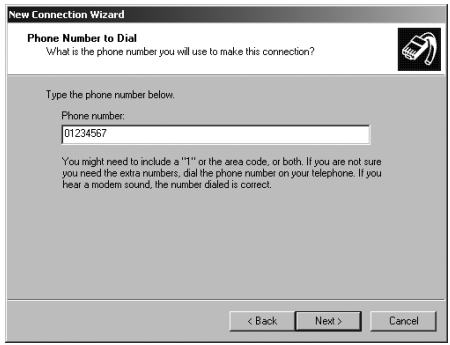
4. A list of the installed modems appears. Select the desired modem and confirm your selection with «Continue».


New Connection Wizard
Select a Device
This is the device that will be used to make the connection.
You have more than one dial-up device on your computer.
Select the devices to use in this connection:
Modem - Standard 33600 bps Modem (COM2)
Modem - Standard 56000 bps Modem (COM1)
< Back
Next >
Cancel

5. Enter a connection name and confirm your entry with «Continue».


New Connection Wizard
Connection Name
Specify a name for this connection to your workplace.
Type a name for this connection in the following box.
Company Name
Sunways AT
For example, you could type the name of your workplace or the name of a server you will connect to.
< Back
Next >
Cancel

6. Specify the phone number of your Sunways Solar Inverter.


New Connection Wizard
Phone Number to Dial
What is the phone number you will use to make this connection?
Type the phone number below.
Phone number:
01234567
You might need to include a "1" or the area code, or both. If you are not sure you need the extra numbers, dial the phone number on your telephone. If you hear a modem sound, the number dialed is correct.
< Back
Next >
Cancel

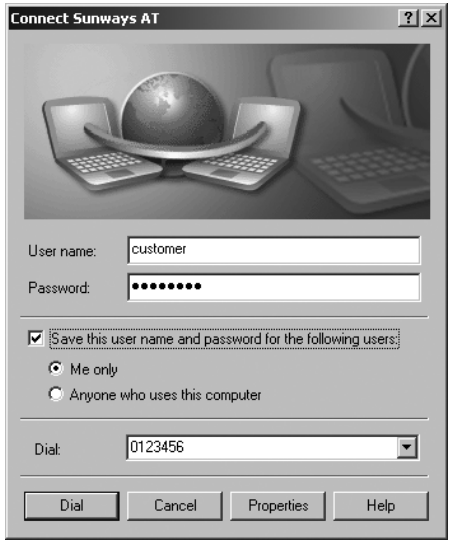
When entering the telephone number, you may need to include one or more digits to connect to an outside line! (An outside line is usually obtained by placing a «0» before the actual telephone number).
Confirm your entry with «Continue».

7. You can now specify whether this connection is to be available to all users of this PC. If in doubt, enter «All users» here and confirm your entry with «Continue».

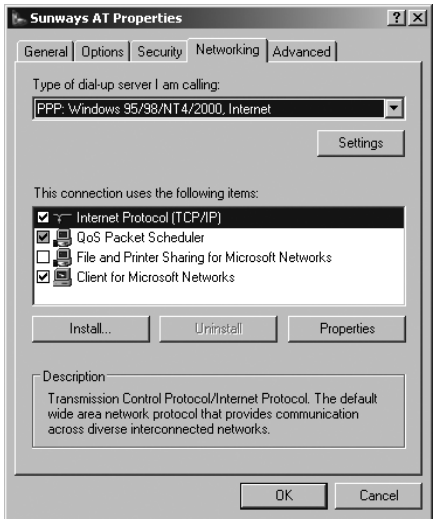
8. Click on the checkbox if you want to reach the connection simply via your desktop and then select «Finish».

New Connection Wizard
Completing the New Connection Wizard
You have successfully completed the steps needed to create the following connection:
012345
• Share with all users of this computer
The connection will be saved in the Network Connections folder.
Add a shortcut to this connection to my desktop
To create the connection and close this wizard, click Finish.
< Back
Finish
Cancel

9. The connection window appears automatically after finishing the connection. (As an alternative via the icon on your desktop or via «Start - Settings - Network Connections»). Here you must now still make other settings, which you can access via «Properties».



10. First select the «Network» tab and mark the entry «Internet Protocol (TCP/IP)» there. Select «Properties».

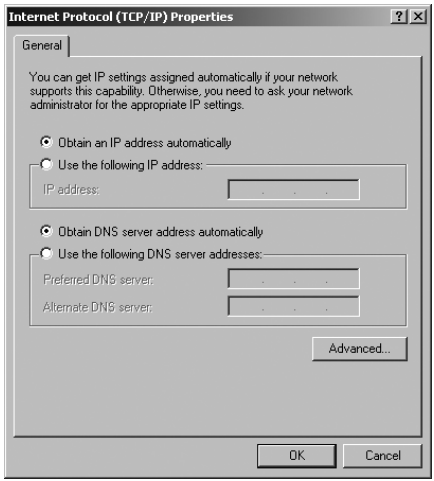


11. Enter the following data:

    Obtain an IP address automatically

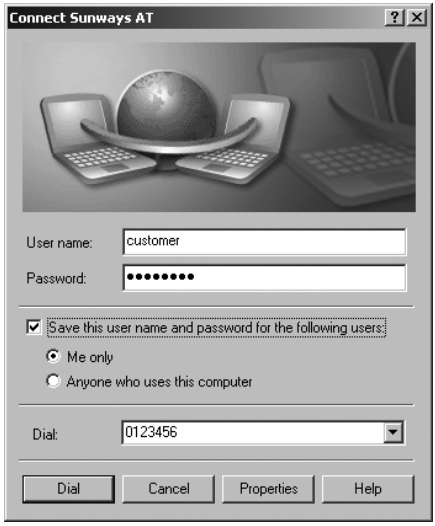
    Obtain DNS server address automatically

    The PC is automatically assigned an IP address by the solar inverter while dialling in. This is **192.168.20.51** as standard and can be set via the Sunways Browser (under «Settings – Modem – PPP-IP»)


Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

12. Enter «customer» as the user name and the standard password (********) or the password you have changed as the password in the connection window.

The password matches the customer password on the unit.



13. The connection is established with «Dial».

After the connection is established you can start the Sunways Browser by entering the IP address of the solar inverter in the address line of your web browser.

General information

The Sunways Browser can be run via a standard Internet browser, e.g. Mozilla Firefox. One of the four possible connections between a PC and the solar inverter is possible for this purpose:

- Direct connection via an Ethernet cable
- Connection via an existing Ethernet network
- Connection via the Internet, e.g. connection of the solar inverter to a DSL connection
- Connection via the Sunways Modem

After entering the IP address of the solar inverter in the address line of the browser, the following functions are available:

- Display of the operating mode and instantaneous values for a single unit or for a CAN-networked system
- Display of energy yields as 5-minute, daily, monthly, annual and total values
- 5-minute mean values of solar generator current and voltage, grid current and voltage and feed-in power
- Settings, e.g. of date/time, interface configuration, alerting options, communication parameters etc.
- Software update of the communication software (LCD display, interfaces, communication and Sunways Browser) and of the control software (control and monitoring)

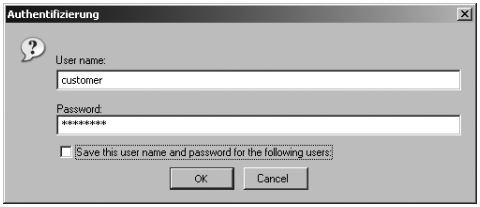
Access protection

The Sunways Browser is provided with password protection so that unauthorised persons cannot access your solar inverter.

The following user data are set in the delivered state:

User: **customer**

Password: * * * * * * * *



It is recommended that you change this password to an 8-digit password.

This password is identical to the password entered via the LCD display to make settings and carry out commissioning.

Should you forget the password, then you can request a device-dependent password from the technical hotline with which you can access your solar inverter again. In this case you should be able to present proof of purchase of the solar inverter.

Overview – Menu

Home – Display of start page

Solar Inverter – Display of the instantaneous values, stored operating data, status of the solar inverter

Solar System – Display of the system overview with status, total output and yields and access to secondary units

Information – Unit information, e.g. serial number

Settings and software update for the unit or the networked system

Language selection

You can display the web pages in German, English, French, Spanish and Italian. Click on the country flags to change over to the respective language.

Setting date/time

This function can be accessed via «Settings – Date/Time». If you have selected the correct time zone and an Internet connection is available, you can automatically synchronise the time of the solar inverter with a time server with the NTP button.

As an alternative you can also transmit the PC time to the solar inverter.

Please note that time settings should only be made with caution, as they directly affect data logging. For example, if you set the time back by 1 hour, then the existing data will be overwritten.

Software update

The software update is used to expand functions on your solar inverter. The communication software (responsible for LCD display, interfaces, communication and Sunways Browser) and the control software can be updated.

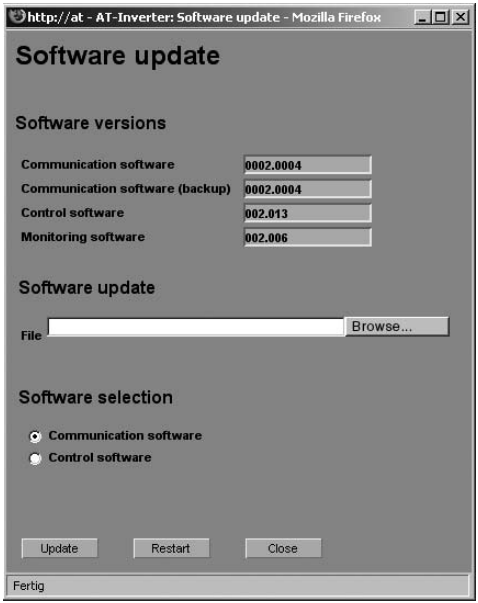
1. Call up the function «Settings – Software Update» for this purpose. This function requires entry of a password (default: ******** or the customer password you have changed).

2. In the upper section of the screen you see the software versions that are currently running. If a new version is made available on our website (www.sunways.de), then you can download this file and load it via the Sunways Browser. Select the file on your hard disk in the File field with the «Browse...» button and confirm the File dialogue with «OK».

3. Then select the software you want to update (communication software, control software or monitoring software).

4. The current software is copied to the solar inverter with the «Update» button.

5. The unit is restarted and the new software is loaded with the «Restart» button.



The unit continues to feed while the communication software is being updated.

Distributing software update to networked units

If there is a CAN bus connection between several solar inverters of the AT series, you can automatically distribute the current software from the main unit to the secondary units. Therefore, you must first update the software of the main unit as described above.

1. In the Sunways Browser the list of all units connected to the CAN bus with the respective software version and the update status can be viewed in the menu «System – System Update».

2. In the lower window you can select the units to be updated. A partial selection is marked by clicking on the first unit with the left mouse button and then pressing the «Shift» key and clicking on the last unit of the partial selection. Individual units are selected by pressing the «Ctrl» key and clicking on all units individually with the left mouse button.

3. Start the software update with the «Update» button.

4. You can track the status of the update by clicking on the «CAN List» button:

   Updt. Pend.
   The software update has not yet been carried out

   Updt. Act.
   The software update is currently being carried out

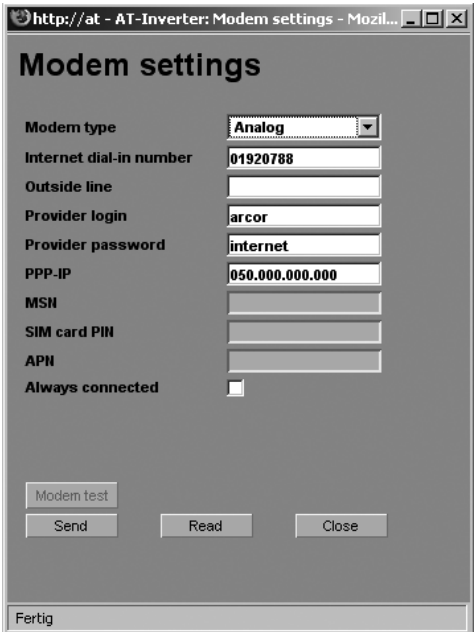
   Updt. OK
   The software update has been completed error-free

   Updt. Err.
   An error has occurred during the software update

If a unit is in the Night mode, the software update will be carried out during the next start

Requirement:
Communication software at least Version 2.0002

Modem settings
If you use a modem for the Internet connection, the modem must be set up accordingly via the Sunways Browser. Therefore, first establish a connection between your PC and the solar inverter (see the chapter Direct Ethernet connection). With the web browser you can then make the following settings in the menu «Settings – Modem»:



Modem type
Selection for the modem type:
Analogue, ISDN or GSM modem

Internet dial-in number
Dial-in number of your Internet provider (ISP)

Outside line
If you have a telephone system, you can, for example, enter a 0 here. A comma produces a dialling pause of 1 second

Provider Login
User name defined by your Internet provider

Provider password
Password defined by your Internet provider

PPP-IP
You reach the solar inverter in your web browser via this IP address. The address is set to **192.168.20.50** in the default setting.

If you are already using the address range 192.168.20.xxx with your computer for another network connection, then you must set another PPP-IP.

Your PC automatically receives the PPP-IP increased by 1 as the IP address of the dial-up connection.

When dialling into the Internet via a dial-up network, the IP address assigned by the Internet provider is entered in this field.

MSN
With an ISDN modem you store the MSN of the extension to which the modem is connected here. This is usually the telephone number of the extension without the area code.
If no MSN is stored, the modem answers all incoming calls!

SIM card PIN
With a GSM modem you enter the PIN of the SIM card here.

APN number
With a GSM modem you enter the APN here (your network operator provides you with this)

Function buttons
The settings are saved in the solar inverter with «Send».

The settings currently stored in the solar inverter are displayed with «Read».

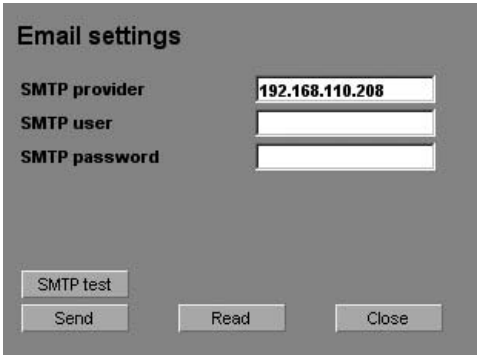
With «Modem Test» you can test the modem connection to the set Internet provider. You receive a reply as to whether dialling in was successful.

Before conducting the modem test, the settings must be stored in the solar inverter with «Send».

Email settings
To enable the solar inverter to send Emails, the Email setting must be stored with the Sunways Browser. The settings can be accessed via «Settings – Network» in the section «Email Settings».

Requirements:

- Communication software at least Version 2.0002
- When dialling in via modem, the correct dial-in settings must be stored (see Internet dial-in via modem).



SMTP provider
SMTP server for sending Emails, e.g. mail.gmx.net (max. of 30 characters)

SMTP user
user name of your Email provider (generally your Email address), e.g. sunways@gmx.de (max. of 50 characters)

SMTP password
Password from your Email provider (max. of 20 characters)

Function buttons
Via «SMTP Test» you can have a test Email sent to the Email address stored for active alerting.

Before conducting the SMTP test, the settings must be stored in the solar inverter with «Send».

The settings are saved in the solar inverter with «Send».

The settings currently stored in the solar inverter are displayed with «Read».

General information

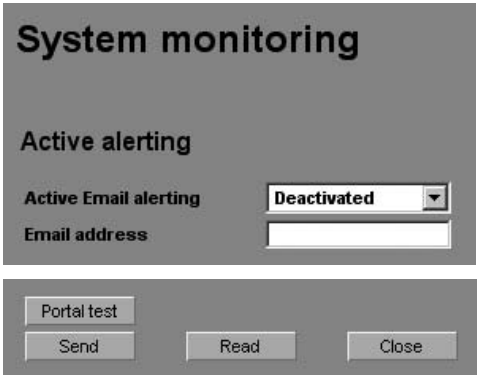
With active alerting you are informed of status messages (errors and warnings) in your solar system by Email. If a status message was active for longer than 15 minutes or occurred 5 times in one day, then you will receive an Email at the next full hour, which is sent to the Email address stored in the solar inverter.

The main unit sends the status messages of all solar inverters if they are CAN-networked.

Requirements:

- Communication software at least Version 2.0002
- A connection of the main unit via a network or modem must be established.
- When dialling in via modem, the correct dial-in settings must be stored (see Internet dial-in via modem).
- Correct Email settings must be stored in the Sunways Browser (see «Email settings»)

Alerting settings
The alerting settings can be accessed with the button «Settings – System Monitoring» in the «Active Alerting» section.



Active alerting
Activation or deactivation of the active alerting function.

Email address
In the «Email address» field you enter the Email address to which the messages are to be sent.

Function buttons
The settings are saved in the solar inverter with «Send».

The settings currently stored in the solar inverter are displayed with «Read».

General information
You can have the operating data of your solar system automatically sent to the Sunways Portal to monitor your system via the Internet. This is possible without using a Sunways Communicator.

The portal connection is configured via the Sunways Browser. Following activation a registration Email is automatically sent to the Sunways Portal by the main unit which contains the system data, e.g. number of units, serial number, etc.

From the activation, the operating data of the day are sent to the Sunways Portal by Email daily before the main unit is switched off for the night. The interval can also be set shorter as an alternative. If a change is made to your solar system (e.g. additional unit), then the change is automatically reported to the Sunways Portal.

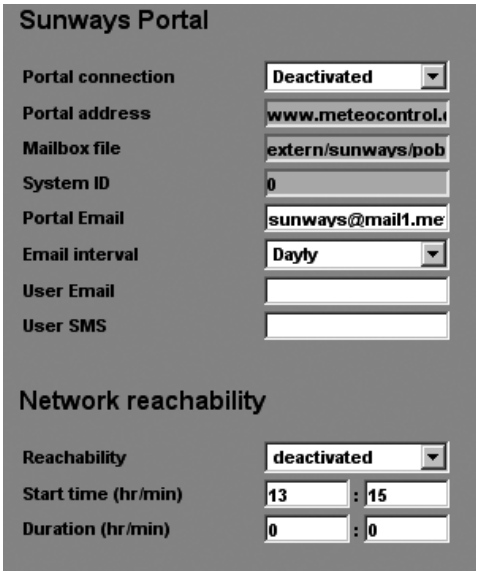
A basis access for the Sunways Portal for displaying the yield data is available to every Sunways customer free of charge. Expanded functions, e.g. the rated/actual comparison in the Sunways Portal, can be purchased for a fee.

Requirements:

- Communication software at least Version 2.0002
- A connection of the main unit via a network or modem must be established.
- When dialling in via modem, the correct dial-in settings must be stored (see Internet dial-in via modem).
- Correct Email settings must be stored in the Sunways Browser (see «Email settings»)
- Correct portal settings must be stored in the Sunways Browser.

Setup
Check whether you meet all requirements. Configure the specified settings if necessary.

Open the setting page in the Sunways Browser. This can be accessed under «Settings – System Monitoring» in the section «Sunways Portal».



Portal connection
Activation or deactivation of the portal connection.

Portal address
Preset for the Sunways Portal

Mailbox file
Preset for the Sunways Portal

System ID
System ID assigned by the portal. This is automatically entered following the portal activation of the solar inverter.

Portal Email
Preset for the Sunways Portal. Here as well, you can enter another address if you want to evaluate the operating data yourself.

Email interval
Select the Email interval. If you operate the system on a DSL modem, you can set a short interval. If you use a modem connection, select a longer interval (e.g. daily) to eliminate unnecessary telephone costs

User Email
In this field you must enter an Email address to which the confirmation Email is sent by the portal. It contains a link for the activation of your system in the Sunways Portal.

User SMS
As an option you can specify an SMS number here to which an SMS message is sent after your system is successfully set up in the portal.

Function buttons
With «Portal Test» you can test the portal connection. You receive an Email at the address in the field «User Email» and an SMS if you have entered your mobile phone number in the field «User SMS».

Before the portal test you must transmit the settings to your solar inverter with «Transmit». If the test was successful, a message is sent to the user Email address or the user SMS address.

The settings are saved in the solar inverter with «Send».

To view your system data in the Sunways Portal, you require a user account. This will be issued to you if you follow the link in the confirmation email and fill out the registration form. As an alternative you can also enter an existing user name with the correct password to assign the system to an existing user account.

7.0 Appendix

7.1 Technical data

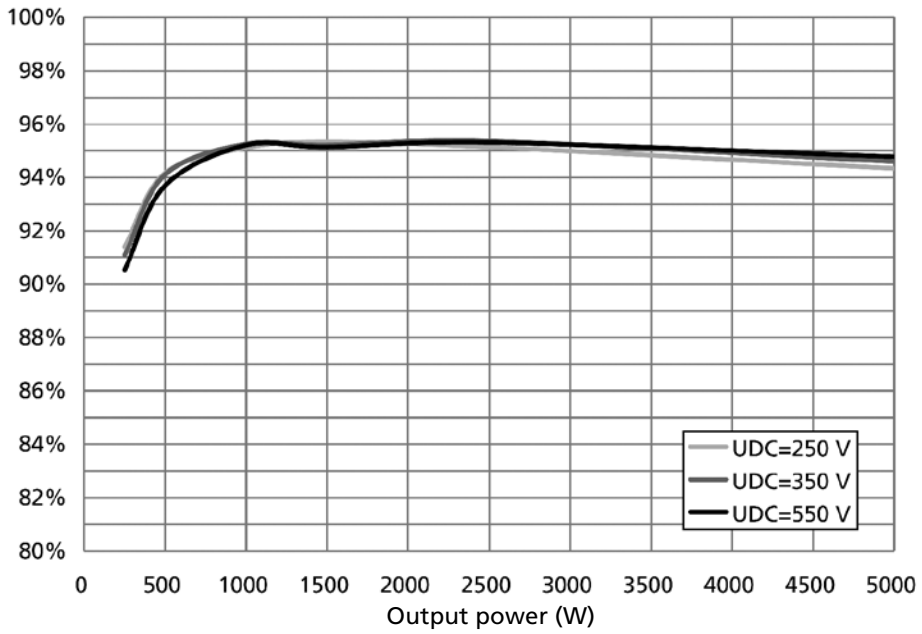
Model	AT 5000	AT 4500	AT 3600	AT 2700
DC Input				
Rated DC power	5200 W	4700 W	3750 W	2800 W
Maximum DC current	22,0 A	22,0 A	15,5 A	15,5 A
Nominal DC voltage	350 V			
MPP voltage range	236...600 V	214...600 V	242...600 V	181...600 V
Maximum voltage DC	680 V			
Number of inputs per MPP tracker	2 x Tyco Solarlok			
Number of MPP trackers	1			
AC output				
Rated AC output power	5000 W	4500 W	3600 W	2700 W
Maximum AC power	5000 W	4500 W	3600 W	2700 W
Nominal AC current	21,7 A	19,6 A	15,7 A	11,7 A
Maximum AC current	23,0 A	21,0 A	17,0 A	12,5 A
Nominal frequency	50 Hz			
Frequency tolerance range	47,5...50,2 Hz (according to DIN VDE 0126-1-1)			
Grid voltage	230 V			
AC voltage range	-20%...+15% (according to DIN VDE 0126-1-1)			
Distortion factor at Pn	< 4%			
Reactive power factor (cos phi)	ca. 1			
Grid voltage monitoring	according to DIN VDE 0126-1-1			
Earth fault protection	RCD (according to DIN VDE 0126-1-1)			

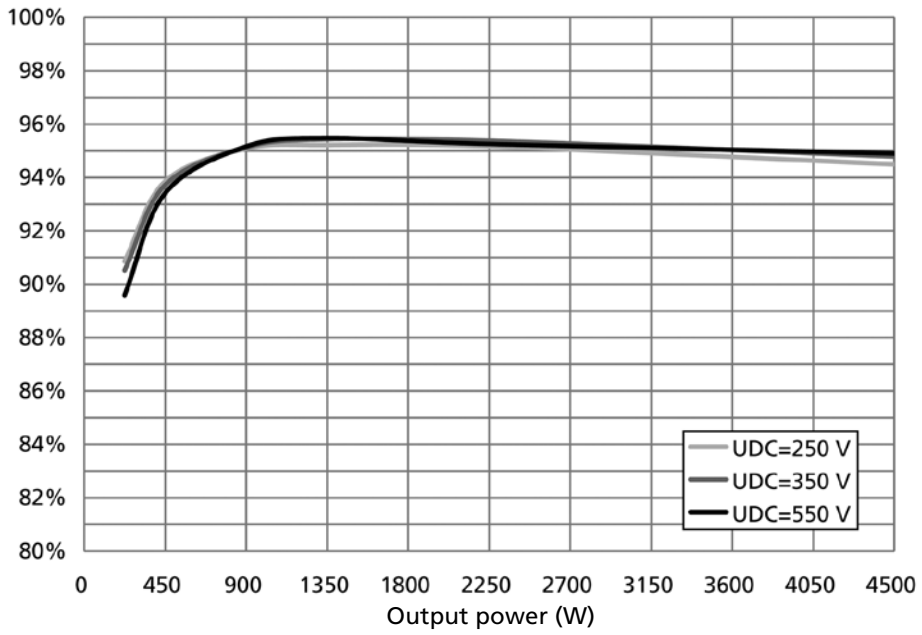
Model	AT 5000	AT 4500	AT 3600	AT 2700
Insulation, frequency and DC current monitoring	integrated according to DIN VDE 0126-1-1			
Required phases, number of grid connections	3 (L1, L2, L3, N, PE)			
Number of feed-in phases (230 V single-phase)	1			
Performance				
Stand-by consumption	6,5 W			
Night-time consumption	< 0,06 W			
Maximum efficiency	95,5%	95,5%	95,5%	95,5%
European efficiency	95,0%	95,0%	94,9%	94,7%
MPP efficiency (static)	99,99%	99,99%	99,99%	99,99%
Switching concept	HERIC® / FP topology, transformerless			
Other				
DC switch	internal, mechanical			
Grid-connection fuse layout	25 A	25 A	25 A	16 A
Data interfaces	Ethernet, CAN, RS485, voltageless alarm relay, S0 pulse output, modem			
Sensor interfaces	irradiation, temperature			
Display	LCD, backlit, 128 x 64 pixels			
Plant supervision	active alarm via e-mail, integrated web-server, Sunways Communictor, Sunways Portal			
IP degree of protection according to IEC 60529	IP 54			

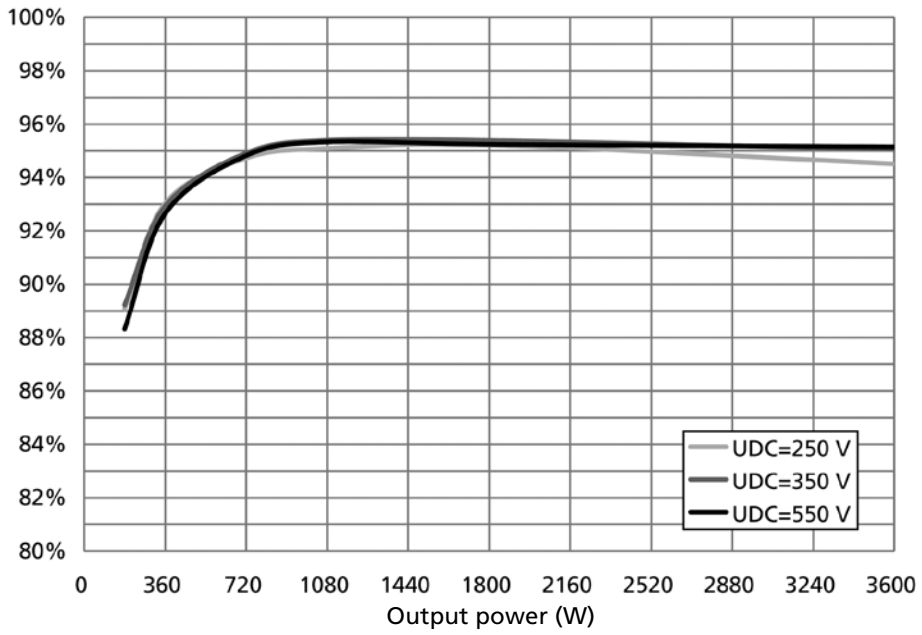
Model	AT 5000	AT 4500	AT 3600	AT 2700
Max. relative humidity	95%			
Cooling	free convection			
Ambient temperature	-25°C...40°C (at full load)			
Overload behaviour	working point adjustment			
Dimensions (height x width x depth)	59 x 35 x 21 cm			
Weight	29 kg			
Type of installation	wall installation			
Noise development	< 35 dB (A)			
Standard warranty (option)	5 years (10 years)			
Certificates	CE, DIN VDE 0126-1-1			

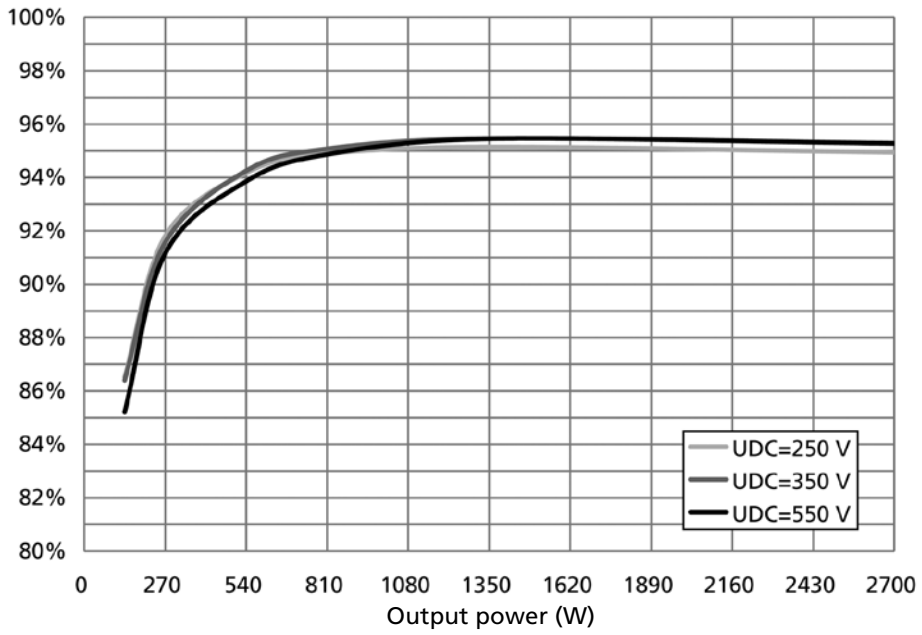
Maximum efficiency in %

		Partial power of the rated output power						Efficiency	
	DC-Voltage	5%	10%	20%	30%	50%	100%	max.	Euro
AT 5000	250 V	91,4	94,2	95,1	95,3	95,1	94,3	95,4	94,8
	350 V	91,1	94,1	95,3	95,2	95,4	94,6	95,5	95,0
	550 V	90,5	93,7	95,2	95,1	95,3	94,8	95,5	94,9
AT 4500	250 V	90,9	93,9	95,1	95,2	95,2	94,5	95,4	94,8
	350 V	90,5	93,7	95,1	95,4	95,4	94,8	95,5	95,0
	550 V	89,6	93,4	95,2	95,5	95,3	94,9	95,5	94,9
AT 3600	250 V	89,1	93,0	94,7	95,1	95,2	94,5	95,3	94,7
	350 V	89,2	92,9	94,9	95,4	95,4	95,1	95,5	94,9
	550 V	88,3	92,6	94,8	95,3	95,2	95,1	95,5	94,8
AT 2700	250 V	86,5	91,8	94,2	94,9	95,1	94,9	95,3	94,5
	350 V	86,4	91,6	94,3	95,1	95,5	95,3	95,5	94,7
	550 V	85,2	91,2	93,9	94,9	95,5	95,3	95,5	94,6


100%
98%
96%
94%
92%
90%
88%
86%
84%
82%
80%
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Output power (W)
UDC=250 V
UDC=350 V
UDC=550 V


100%
98%
96%
94%
92%
90%
88%
86%
84%
82%
80%
0
450
900
1350
1800
2250
2700
3150
3600
4050
4500
Output power (W)
UDC=250 V
UDC=350 V
UDC=550 V


100%
98%
96%
94%
92%
90%
88%
86%
84%
82%
80%
0
360
720
1080
1440
1800
2160
2520
2880
3240
3600
Output power (W)
UDC=250 V
UDC=350 V
UDC=550 V


100%
98%
96%
94%
92%
90%
88%
86%
84%
82%
80%
0
270
540
810
1080
1350
1620
1890
2160
2430
2700
Output power (W)
UDC=250 V
UDC=350 V
UDC=550 V

7.4 General liability disclaimer

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